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MINERAL RESOURCES
OF THE
UNITED STATES
1930

PART I—METALS

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BUREAU OF MINES
SCOTT TURNER, Director

MINERAL RESOURCES
OF THE
UNITED STATES
1930

O. E. KIESSLING
Chief Economist, Division of Mineral Statistics

PART I—METALS

UNITED STATES
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CONTENTS

Page
Introduction, by O. E. Kiessling A1
Summary, by Martha B. Clark A5
Prefatory note to the reports on gold, silver, copper, lead, and zinc, by O. E. Kiessling A121
Antimony, by Paul M. Tyler 1
Gold, silver, copper, lead, and zinc in the Eastern States, by J. P. Dunlop 17
Arsenic, bismuth, selenium, and tellurium, by V. C. Heikes 25
Mercury, by Paul M. Tyler 31
Iron ore, pig iron, and steel, by Hubert W. Davis 57
Platinum and allied metals, by Hubert W. Davis 99
Lead and zinc pigments and salts, by Elmer W. Pehrson 113
Vanadium, uranium, and radium, by Frank L. Hess 133
Bauxite and aluminum, by C. E. Julihn 151
Tungsten, by Frank L. Hess 179
Silver, copper, lead, and zinc in the Central States, by J. P. Dunlop and H. M. Meyer 209
Chromite, by Lewis A. Smith 243
Cobalt, molybdenum, tantalum, titanium, and various rare metals, by Paul M. Tyler and Alice V. Petar 267
Manganese and manganiferous ores, by Robert H. Ridgway 297
Secondary metals, by J. P. Dunlop 333
Tin, by Charles White Merrill 355
Gold, silver, copper, lead, and zinc in Montana, by T. H. Miller 385
Zinc, by Elmer W. Pehrson 431
Lead, by Elmer W. Pehrson 479
Gold, silver, copper, lead, and zinc in Nevada, by V. C. Heikes 515
Gold, silver, copper, lead, and zinc in Utah, by C. N. Gerry and Paul Luff 555
Gold, silver, copper, lead, and zinc in Idaho, by C. N. Gerry and T. H. Miller 611
Gold, silver, copper, lead, and zinc in Washington, by C. N. Gerry and T. H. Miller 661
Gold, silver, and lead in South Dakota, by Charles W. Henderson 679
Gold, silver, and copper in Wyoming, by Charles W. Henderson 687
Copper, by C. E. Julihn and H. M. Meyer 691
Ore-concentration statistics, by T. H. Miller and R. L. Kidd 749
Gold, silver, copper, lead, and zinc in New Mexico, by Charles W. Henderson 793
Gold, silver, copper, and lead in Texas, by Charles W. Henderson 813
Gold and silver, by J. P. Dunlop 817
Mineral production of the world, 1924–1929, by L. M. Jones 859
Gold, silver, copper, lead, and zinc in California, by V. C. Heikes 963
Gold, silver, copper, lead, and zinc in Oregon, by V. C. Heikes 1029
Gold, silver, copper, lead, and zinc in Colorado, by Charles W. Henderson 1047
Gold, silver, copper, lead, and zinc in Arizona, by C. N. Gerry and T. H. Miller 1085

MINERAL RESOURCES OF THE UNITED STATES, 1930—PART I

THE MINERAL RESOURCES OF THE UNITED STATES IN 1930[1]

INTRODUCTION

By O. E. Kiessling

Chief Economist, Division of Mineral Statistics

One of the functions of the United States Bureau of Mines is the annual publication of some 60 printed economic and statistical surveys covering important branches of the mineral industry. These reports, made possible through the cooperation of mineral producers, accurately indicate output, values, distribution, stocks, and other factors of economic interest regarding mineral products. Technological advances in mining or in the preparation of minerals for use are noted with interest, but they are viewed chiefly from the standpoint of their actual or potential economic implications. The studies are organized principally on a commodity basis, and an individual chapter usually covers a single mineral or a group of related mineral products. The commodity reports, however, are supplemented by 15 additional State and district mining reviews that analyze carefully important mining developments in areas throughout the United States producing gold, silver, copper, lead, and zinc.

This report, the forty-eighth of an annual series, is published in two parts. Part I contains a general summary of all mineral products, the prefatory note to the chapters on gold, silver, copper, lead, and zinc giving average prices at which values of the metals are calculated, and 35 chapters of which 15 are State or regional reports relating to gold, silver, copper, lead, and zinc mining, 18 are general reports on various metals or metalliferous mineral products, 1 gives statistics on ore concentration, and 1 gives statistics on mineral production of the world, 1924 to 1929, by countries. Part II consists of 30 chapters, each relating to one, or a group, of the nonmetallic mineral products, including the mineral fuels—coal, oil, and gas.

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[1] In Mineral Resources of the United States the use of leaders (----) indicates that so far as the Bureau of Mines has been able to ascertain there was nothing to report. If data are not available, the fact is indicated by a statement to that effect in a footnote. Leaders are also used in footings where it is quite evident that figures in a column are not addable and in other places where entries are not appropriate.

All figures of imports and exports in this report, unless otherwise stated, were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce, having been converted by Mr. Dorsey to the various units of measurement used in this report and arranged by him in their present form. The imports are those for the calendar year unless otherwise stated. Wherever exports are shown, unless otherwise specified, the figures represent domestic products and not foreign minerals reexported, and they also cover calendar years.

SALIENT FEATURES OF 1930 STATISTICS

With respect to the combined production of all mineral products, the year 1930 may be characterized as one of sharply declining output and values. With the exception of gold—and of a few mineral products of relatively minor importance—the downward trend in values was wide-sweeping in effect. From a study of business cycles it has been determined that unit values of mineral products reflect regularly changes in business conditions.[2] Thus, as might be expected, the lower total sales realizations in 1930, accounted for by decreased unit prices and by the falling off in output of nearly all mineral products, are explained principally by the world business depression that affected most lines of industrial activity. The year began with the immediate future of the mineral industries somewhat uncertain following the stock-market debacle of 1929; however, by midsummer the full effect of tendencies making for retrenchment was apparent. No immediate improvement was in sight as the year closed with accumulating stocks and with the trends toward lower production and values unarrested.

Thus, due to adverse business conditions, the aggregate value of all mineral products in the United States in 1930, $4,764,800,000, reached the lowest point since 1922. This figure, as compared with the total value for 1929, represented a reduction of 19 per cent. It is of interest, however, that the relative decline in value between 1930 and 1929 is only about one-half as severe as the 41 per cent decrease shown by the total value for 1921 as contrasted with the all-time record year of 1920. The 1930 total value was approximately equal to that reported for 1919 and 1922 and was approximately double that reported for any of the pre-war years 1912 to 1915. Comparisons for the various individual mineral products in 1930 show only minor and scattered departures from the common downward trend in quantities and values, and no notable increases are recorded. The intensity of the decline, moreover, was far from uniform, and some branches of the mineral industry suffered much less than others.

The mineral fuels as a group showed a decrease of about 13 per cent in value of total products. Less bituminous coal and anthracite were produced in 1930 than in any postwar year free from serious labor difficulties, and the average unit sales realizations were somewhat lower than in immediately preceding years. Petroleum production decreased for the first time in six years; the output in 1930 dropped sharply to a level below that of any of the preceding three years, and the total value declined in somewhat larger ratio. The production of natural gas increased, while the total value remained approximately the same as in 1929; a decline in the output of natural gasoline was accompanied by a much larger relative decrease in total value.

The total value of metals produced in the United States in 1930 decreased about 33 per cent from 1929. Most striking were the notable declines in value of the major metals, ranging from 30 to 49 per cent for copper, pig iron, lead, silver, and zinc. The decreases for some of the other metals, such as mercury, were somewhat more moderate. Only gold, the standard price of which was not affected by the business depression, showed an increase in value that accompanied a gain of 3.5 per cent in output. Aluminum, manganese ore, and cadmium made moderate gains in production, but the total values were slightly less than in the preceding year. All producers of metals felt sharply the effect of weakened prices and generally reduced output.

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[2] Mitchell, W. C., Business Cycles: Univ. California Press, p. 572.

Compared with the relatively large drop in the aggregate value of metals, the total value of nonmetallic products (not including fuels) showed the comparatively moderate decline of 17 per cent. Prices were almost universally lower than in 1929; and output was usually reduced, especially during the latter half of the year. In contrast to the general trend, however, both the quantity and value of arsenic, borates, bromine, calcium-magnesium chloride, fuller's earth, and phosphate rock increased. Gains in the output of pyrites, asbestos, and scrap mica were offset by unit prices low enough to indicate lower total values for each of these products. The various Government road and public-building programs, fostered to alleviate unemployment, were apparently insufficient to offset the loss of demand for nonmetallic structural materials occasioned by the pronounced retrenchment in commercial building projects. All of the important nonmetallic building materials—stone, sand, gravel, gypsum, lime, cement, asphalt, slate, mineral paints, sand-lime brick, and clay—showed moderate to marked decreases in total value in 1930.

SUMMARY

By Martha B. Clark[1]

PLAN OF REPORT

The scope of this series of summaries has been maintained with little change. The first four (1918 to 1921), in preliminary form, did not contain tables of production by States. Since 1922 the preliminary issues have carried State tables for the two years preceding the year designated by title. In the final form these reports have all contained tables of production by States for the title year. The plan of the reports comprises: (1) General summary tables of production; (2) detailed tables giving data on domestic production and on imports and exports of the various minerals, arranged in alphabetic order, for a series of years, and giving data on consumption, stocks, etc., for some important products; (3) State tables in alphabetic order. Thus, the summary is a recapitulation of the statistical material contained in both volumes of Mineral Resources of the United States.

Unit of measurement.—The unit of measurement used by the Bureau of Mines for each mineral product in the reports on the mineral resources is that common to the industry concerned, and the variation in these units makes it impracticable, if not impossible, directly to combine and compare the different minerals except as to value, especially because some products are measured by volume, although most are measured by weight.

Elimination of duplication.—In the totals for the United States, shown in the following general tables, duplication has been eliminated wherever practicable, and in the State totals given in the State tables virtually all duplication has been eliminated. For instance, in both general and State tables the output of coke is shown, but its value is not included in the totals, as the value of the coal used in its manufacture enters into the value of the coal production, which is included in the totals. The value of the products of the clay industries is included in both general and State totals as representing the first marketable form of the greater part of the clay produced; the quantity and value of the clay mined and sold in the raw state by miners to users of clay are shown separately, but the value is not included in the totals.

In the general tables both iron ore and pig iron are shown, but the value of the pig iron rather than that of the iron ore is included in the totals, as that is considered the better means of presenting the statistics for iron in its first marketable form. For gold, silver, copper, lead, and zinc the value of "smelter output" is included in the general totals, and in order to account more fully for the value of the ores treated these smelter figures are supplemented by the value of the by-product sulphuric acid. The value of pigments (white lead, red lead, lithopone, litharge, and orange mineral) manufactured from metals is not included in the general tables, as the base from which they are made is included in the output of lead or zinc, whereas the value of sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide is included, as these are made in large part direct from the ores and do not enter into the lead or zinc totals, which represent smelter output.

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[1] The assistance of Ora McNeill, of the Bureau of Mines, is gratefully acknowledged.

In the State tables also iron ore and pig iron are both shown. As blast-furnace products can not be distributed according to the States in which the ore is mined, the value of the ore is used in the State totals. For ores of gold, silver, copper, lead, and zinc no values are shown, and in fact none are recorded; instead, for each of these metals the recoverable content of the ores is used as the basis of valuation. The value of the zinc and lead pigments is not included in the State total, as the recoverable zinc and lead content of the ores from which the products were made is included under zinc or lead. The value of the sulphuric acid produced as a by-product of copper and zinc smelting is not included in the State total, as tracing this product back to the State producing the ore has not been possible.

GENERAL TABLES

Mineral products of the United States, 1929 and 1930 [1]

Product	1929		1930	
	Quantity	Value	Quantity	Value
METALLIC				
Aluminum.......pounds	225, 000, 000	$51, 864, 000	229, 035, 000	$50, 961, 000
Antimonial lead [2]...short tons (2,000 pounds)	25, 669	3, 267, 095	13, 711	1, 392, 524
Antimony [3].......do	3, 052	545, 700	1, 685	258, 500
Bauxite.......long tons (2,240 pounds)	365, 777	2, 265, 638	330, 612	1, 928, 297
Cadmium.......pounds	2, 481, 427	2, 009, 956	2, 777, 762	1, 777, 768
Chromite.......long tons	269	3, 976	80	1, 905
Copper,[4] sales value.......pounds	2, 002, 863, 135	352, 504, 000	1, 394, 389, 327	181, 271, 000
Ferro-alloys.......long tons	829, 324	75, 506, 078	650, 240	51, 900, 220
Gold [5].......troy ounces	2, 208, 386	45, 651, 400	2, 285, 603	47, 247, 600
Iron:				
Ore [6].......long tons	75, 602, 734	[6] 197, 148, 640	55, 201, 221	[6] 145, 619, 059
Pig.......do	41, 549, 161	731, 858, 075	29, 905, 355	512, 165, 131
Lead (refined),[4] sales value.......short tons	672, 498	84, 735, 000	573, 740	57, 374, 000
Manganese ore (35 per cent or more Mn).......long tons	60, 379	1, 612, 357	67, 035	1, 437, 465
Manganiferous ore (5 to 35 per cent Mn).......long tons	1, 188, 258	3, 274, 466	785, 390	2, 401, 605
Mercury:				
Metal.......flasks (76 pounds net)	23, 682	2, 892, 638	21, 553	2, 478, 789
Ore.......short tons	(7)	(8)	(7)	(8)
Nickel (value at New York City).......do	340	297, 273	308	213, 803
Ores (crude), old tailings, etc.:				
Copper.......do	68, 422, 000	(8)	47, 382, 000	(8)
Copper-lead and copper-lead-zinc.......do	259, 000	(8)	246, 000	(8)
Dry and siliceous (gold and silver).......do	7, 671, 000	(8)	7, 767, 000	(8)
Lead.......do	8, 165, 000	(8)	8, 080, 000	(8)
Lead-zinc.......do	14, 469, 000	(8)	10, 645, 000	(8)
Zinc.......do	7, 193, 000	(8)	5, 980, 000	(8)
Platinum and allied metals (value at New York City).......troy ounces	47, 977	3, 121, 471	43, 502	2, 048, 824
Silver.......do	61, 327, 868	32, 687, 754	50, 748, 127	19, 538, 029
Tin (metallic equivalent).......short tons	39	35, 600	17	10, 500
Titanium ore:				
Ilmenite.......do	(9)	(9)	(9)	(9)
Rutile.......do	(9)	(9)	(9)	(9)
Tungsten ore (60 per cent concentrates).......do	830	654, 000	702	509, 000
Uranium and vanadium ores.......do	(9)	(9)	(9)	(9)
Zinc,[4] sales value.......do	612, 136	80, 802, 000	489, 361	46, 979, 000
Total value of metallic products (approximate)	....	1, 475, 990, 000	....	982, 550, 000
NONMETALLIC				
Arsenious oxide.......short tons	14, 546	883, 771	17, 425	1, 008, 385
Asbestos.......do	3, 155	351, 004	4, 242	289, 284
Asphalt:				
Native.......do	804, 027	5, 470, 493	702, 777	4, 463, 092
Oil [6].......do	2, 332, 973	[6] 24, 135, 787	2, 273, 546	[6] 21, 570, 439
Barite (crude).......do	277, 269	1, 850, 706	234, 932	1, 538, 171
Borates (colemanite and naturally occurring sodium borates).......short tons	169, 870	4, 515, 375	177, 360	5, 351, 999
Bromine.......pounds	6, 414, 620	1, 759, 325	8, 462, 800	2, 109, 974
Calcium-magnesium chloride.......short tons	114, 240	2, 097, 061	116, 160	2, 207, 800
Cement.......barrels (376 pounds net)	172, 027, 452	255, 104, 506	160, 846, 350	231, 249, 287
Clay:				
Products [10]	....	373, 409, 391	....	275, 134, 322
Raw [6].......short tons	4, 347, 020	[6] 14, 850, 744	3, 962, 903	[6] 12, 521, 495
Coal:				
Bituminous [11].......do	534, 988, 593	952, 781, 000	467, 526, 299	795, 483, 000
Pennsylvania anthracite.......long tons	65, 918, 031	385, 642, 751	61, 950, 747	354, 574, 191
Coke [6].......short tons	59, 883, 845	[6] 278, 994, 592	47, 972, 021	[6] 209, 137, 262
Diatomite and tripoli [12].......do	38, 011	545, 658	32, 439	507, 505
Emery.......do	924	10, 722	555	5, 996
Feldspar (crude).......long tons	197, 699	1, 276, 640	171, 788	1, 066, 636
Fluorspar.......short tons	146, 439	2, 791, 126	95, 849	1, 746, 643
Fuller's earth.......do	315, 983	4, 309, 723	335, 644	4, 326, 705
Garnet for abrasive purposes.......do	5, 961	435, 420	5, 003	314, 129
Gems and precious stones	....	(13)	....	(13)
Graphite:				
Amorphous.......short tons	3, 555	46, 650	1, 941	20, 525
Crystalline.......pounds	5, 806, 410	264, 241	(14)	(14)
Grindstones and pulpstones.......short tons	27, 736	1, 241, 546	18, 700	770, 571
Gypsum.......do	5, 016, 132	31, 292, 969	3, 471, 393	27, 051, 484
Lime.......do	4, 269, 768	33, 478, 848	3, 387, 880	25, 616, 486
Magnesite (crude).......do	187, 660	1, 500, 000	129, 320	1, 033, 130

Footnotes at end of table.

Mineral products of the United States, 1929 and 1930—Continued

Product	1929		1930	
	Quantity	Value	Quantity	Value
NONMETALLIC—continued				
Mica:				
Scrap ... short tons	6, 253	$117, 901	6, 732	$109, 100
Sheet ... pounds	2, 035, 128	286, 321	1, 465, 485	177, 307
Millstones		31, 407		17, 702
Mineral paints:				
Natural pigments [15] ... short tons	(15)	(15)	(15)	(15)
Zinc and lead pigments [16] ... do	204, 574	26, 211, 556	147, 948	18, 420, 436
Mineral waters ... gallons sold	(13)	(13)	(13)	(13)
Natural gas ... M cubic feet	1, 917, 693, 000	413, 276, 000	1, 943, 421, 000	416, 090, 000
Natural gasoline ... gallons	2, 233, 688, 000	158, 410, 000	2, 210, 494, 000	128, 160, 000
Oilstones, etc ... short tons	838	212, 017	651	137, 184
Peat ... do	(13)	(13)	(13)	(13)
Petroleum ... barrels (42 gallons)	1, 007, 323, 000	1, 280, 417, 000	898, 011, 000	1, 070, 200, 000
Phosphate rock ... long tons	3, 760, 855	13, 155, 259	3, 926, 392	13, 996, 830
Potassium salts ... short tons	[17] 57, 540	2, 988, 148	[17] 56, 610	2, 986, 157
Pumice ... do	[18] 67, 013	[18] 353, 064	56, 843	336, 099
Pyrites ... long tons	333, 465	1, 250, 141	347, 512	1, 028, 680
Salt ... short tons	8, 543, 560	27, 334, 695	8, 054, 440	25, 009, 480
Sand:				
Glass ... do	2, 219, 677	3, 788, 471	1, 849, 101	3, 210, 973
Molding, building, etc., and gravel ... do	220, 352, 228	129, 047, 508	195, 202, 625	111, 965, 570
Sand-lime brick [19] ... thousands	269, 584	2, 909, 635	191, 193	1, 950, 709
Silica (quartz) ... short tons	20, 981	205, 759	13, 156	121, 289
Slate ... do	670, 070	11, 245, 178	463, 610	7, 911, 618
Stone ... do	141, 109, 580	202, 692, 762	126, 996, 340	178, 948, 611
Sulphur ... long tons	2, 437, 238	43, 800, 000	1, 989, 917	35, 800, 000
Sulphuric acid (60° Baumé) from copper and zinc smelters ... short tons	[18] 1, 260, 456	[18] 10, 016, 506	1, 188, 316	9, 544, 283
Talc and soapstone [20] ... do	219, 783	2, 628, 662	179, 385	2, 108, 338
Total value of nonmetallic products (approximate)		4, 401, 180, 000		3, 773, 400, 000
SUMMARY				
Total value of metallic products		1, 475, 990, 000		982, 550, 000
Total value of nonmetallic products (exclusive of mineral fuels)		1, 210, 653, 000		1, 008, 900, 000
Total value of mineral fuels		3, 190, 527, 000		2, 764, 500, 000
Total value of "unspecified" (metallic and nonmetallic) products (partly estimated) [21]		10, 430, 000		[21] 8, 850, 000
Grand total approximate value of mineral products		5, 887, 600, 000		4, 764, 800, 000

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[1] In this general statement certain of the figures represent shipments rather than quantity mined. The reader is referred to the following sections on the various mineral products for information in greater detail than it seems practicable to give here.

[2] From both domestic and foreign ores.

[3] Figures represent antimony content of antimonial lead. Value excluded from metallic total as the value of the antimony is included in the antimonial lead value.

[4] Product from domestic ores only.

[5] Value, $20.671834625323 an ounce.

[6] Value not included in total value.

[7] Figures not available.

[8] Figures showing values not available.

[9] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.

[10] Figures obtained through cooperation with Bureau of the Census.

[11] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.

[12] Figures represent tripoli only. Value of diatomite is included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[13] No canvass. Estimate of value included in total value of nonmetallic products.

[14] Value included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[15] Canvass discontinued after 1915. Value of iron ore sold for paint included under last item ("Unspecified").

[16] Sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

[17] Equivalent as K_2O.

[18] Revised figures.

[19] According to Bureau of the Census.

[20] Figures represent talc only. Value of soapstone is included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[21] Includes for 1930 the value of bismuth, cadmium compounds ($323,718), chats ($446,000), columbite ($3,500), flint lining for tube mills and pebbles for grinding ($50,816), optical fluorspar, iodine, iron ore sold for magnets, iron ore sold for paint ($51,520), lithium minerals ($56,327), new ingot magnesium ($268,864), natural magnesium salts ($1,071,112), calcareous marl ($112,523), greensand marl ($221,211), micaceous minerals ($70,713), molybdenum ($2,068,000), selenium ($454,911), silica sand and sandstone (finely ground) ($1,000,500), sodium salts (carbonate, bicarbonate, sulphate, and trona) from natural sources ($1,792,079) sulphur ore, tellurium ($7,906), and an estimate of the value of miscellaneous mineral products, statistics for which are not collected annually by the Bureau of Mines.

Value of mineral products of the United States, 1880–1930

Year	Metallic		Nonmetallic		Unspecified (metallic and nonmetallic)	Total	
	Value	Percentage of increase or decrease	Value	Percentage of increase or decrease		Value	Percentage of increase or decrease
1880	$187, 881, 000	----------	$173, 582, 000	----------	$6, 000, 000	$367, 463, 000	--------
1881	189, 413, 000	+0. 8	207, 207, 000	+19	6, 500, 000	403, 120, 000	+10
1882	215, 820, 000	+14	230, 786, 000	+11	6, 500, 000	453, 106, 000	+12
1883	197, 881, 000	−8	243, 680, 000	+6	6, 500, 000	448, 061, 000	−1
1884	180, 284, 000	−9	221, 756, 000	−9	5, 000, 000	407, 040, 000	−9
1885	172, 218, 000	−4	242, 333, 000	+9	5, 000, 000	419, 551, 000	+3
1886	204, 400, 000	+19	250, 995, 000	+4	790, 000	456, 185, 000	+9
1887	240, 791, 000	+18	294, 057, 000	+17	785, 000	535, 633, 000	+17
1888	242, 010, 000	+. 5	310, 889, 000	+6	900, 000	553, 799, 000	+3
1889	250, 325, 000	+3	291, 001, 000	−6	997, 000	542, 326, 000	−2
1890	303, 440, 000	+21	310, 995, 000	+7	994, 000	615, 429, 000	+13
1891	280, 485, 000	−8	319, 364 000	+3	1, 000, 000	600, 849, 000	−2
1892	283, 715, 000	+1	337, 517, 000	+6	1, 000, 000	622, 232, 000	+4
1893	223, 154, 000	−21	321, 339, 000	−5	1, 000, 000	545, 493, 000	−12
1894	186, 835, 000	−16	362, 410, 000	+13	1, 000, 000	550, 245, 000	+. 9
1895	248, 033, 000	+33	393, 658, 000	+9	1, 000, 000	642, 691, 000	+17
1896	252, 075, 000	+2	387, 966, 000	−1	1, 000, 000	641, 041, 000	−. 3
1897	269, 934, 000	+7	380, 678, 000	−2	1, 000. 000	651, 612, 000	+2
1898	308, 247, 000	+14	417, 795, 000	+10	1, 000, 000	727, 042, 000	+12
1899	483, 521, 000	+57	525, 575, 000	+26	1, 000, 000	1, 010, 096, 000	+39
1900	513, 732, 000	+6	594, 204, 000	+13	1, 000, 000	1, 108, 936, 000	+10
1901	493, 314, 000	−4	660, 764, 000	+11	1, 000, 000	1, 155. 078, 000	+4
1902	604, 517, 000	+23	722, 434, 000	+9	1, 000, 000	1, 327, 951, 000	+15
1903	588, 753, 000	−3	905, 628, 000	+25	1, 000, 000	1, 495, 381, 000	+13
1904	501, 114, 000	−15	857, 667, 000	−5	400, 000	1, 359, 181, 000	−9
1905	702, 585, 000	+40	920, 780, 000	+7	400, 000	1, 623, 765, 000	+19
1906	886, 180, 000	+26	1, 014, 500, 000	+10	200. 000	1, 900, 880, 000	+17
1907	904, 108, 000	+2	1, 165, 376, 000	+15	86, 000	2, 069, 570, 000	+9
1908	550, 768, 000	−39	1, 040, 761, 000	−11	244, 000	1, 591, 773, 000	−23
1909	754, 944, 000	+37	1, 131, 866, 000	+9	297, 000	1, 887, 107, 000	+19
1910	749, 879, 000	−. 7	1, 237, 668, 000	+9	297, 000	1, 987, 844, 000	+5
1911	680, 907, 000	−9	1, 242, 942, 000	+. 4	232, 000	1, 924, 081, 000	−3
1912	862, 008, 000	+27	1, 375, 420. 000	+11	366, 000	2, 237, 794, 000	+16
1913	878, 869, 000	+2	1, 554, 298, 000	+13	378, 000	2, 433, 545, 000	+9
1914	686, 639, 000	−22	1, 424, 063, 000	−8	470, 000	2, 111, 172, 000	−13
1915	991, 730, 000	+44	1, 400, 484, 000	−2	2, 430, 000	2, 394, 644, 000	+13
1916	1, 620, 745, 000	+63	1, 884, 413, 000	+35	3, 281, 000	3, 508, 439, 000	+47
1917	2, 086, 234, 000	+29	2, 900, 462, 000	+54	5, 800, 000	4, 992, 496, 000	+42
1918	2, 153, 318, 000	+3	3, 380, 690, 000	+17	6, 700, 000	5, 540, 708, 000	+11
1919	1, 359, 744, 000	−37	3, 232, 626, 000	−4	3, 400, 000	4, 595, 770, 000	−17
1920	1, 762, 350, 000	+30	5, 214, 170, 000	+61	4, 820, 000	6, 981, 340, 000	+52
1921	654, 130, 000	−63	3, 481, 720, 000	−33	2, 650, 000	4, 138, 500, 000	−41
1922	987, 180, 000	+51	3, 656, 410, 000	+5	3, 700, 000	4, 647, 290, 000	+12
1923	1, 510, 930, 000	+53	4, 471, 620, 000	+22	3, 950, 000	5, 986, 500, 000	+29
1924	1, 232, 330, 000	−18	4, 067, 730, 000	−9	5, 740, 000	5, 305, 800, 000	−11
1925	1, 380, 280, 000	+12	4, 291, 100, 000	+5	6, 250, 000	5, 677, 630, 000	+7
1926	1, 402, 920, 000	+2	4, 803, 080, 000	+12	7, 600. 000	6, 213, 600, 000	+9
1927	1, 217, 700, 000	−13	4, 304, 100, 000	−10	8, 200, 000	5, 530. 000. 000	−11
1928	1, 284, 580, 000	+5	4, 091, 620, 000	−5	9, 000. 000	5, 385. 200, 000	−3
1929	1, 475, 990, 000	+15	4, 401, 180, 000	+8	10. 430, 000	5, 887. 600, 000	+9
1930	982, 550, 000	−33	3, 773, 400, 000	−14	8, 850, 000	4, 764, 800, 000	−19
Grand total	37, 381, 490, 000	----------	81, 426, 762, 000	----------	149, 137, 000	118, 957, 389, 000	--------

Value of mineral products of the United States, 1926–1930, by States [1]

State	1926	1927	1928	1929	1930
Alabama	$83,709,894	$78,640,669	$69,807,334	$65,402,354	$55,461,985
Alaska	17,606,890	14,402,440	14,024,489	15,946,830	13,707,235
Arizona	116,047,987	100,558,556	115,999,643	157,959,792	82,933,802
Arkansas	84,485,672	59,449,100	45,009,780	41,324,576	34,901,476
California	524,282,257	459,497,072	434,261,175	555,001,213	479,049,507
Colorado	65,597,487	58,855,263	58,594,688	55,331,911	46,270,545
Connecticut	7,695,341	7,299,100	7,599,655	7,053,468	5,485,120
Delaware	375,945	493,377	481,584	467,493	424,901
District of Columbia	987,289	1,374,719	1,031,216	1,064,946	1,288,344
Florida	19,700,522	18,065,961	15,227,123	14,803,606	15,484,206
Georgia	17,479,967	16,758,390	14,740,431	15,294,103	12,830,845
Idaho	31,752,821	29,183,929	28,589,221	32,142,685	22,903,659
Illinois	237,241,600	180,393,779	188,098,866	182,791,131	148,311,418
Indiana	118,692,364	107,578,234	98,583,915	96,961,947	79,226,808
Iowa	35,971,787	33,426,375	35,498,669	35,954,895	33,357,958
Kansas	165,060,612	120,368,526	113,279,524	124,472,480	100,253,311
Kentucky	146,768,273	152,614,177	131,969,907	132,649,508	111,691,254
Louisiana	62,203,543	51,266,921	56,810,403	62,725,997	71,929,038
Maine	5,785,619	5,475,695	5,922,729	6,748,799	6,227,528
Maryland	24,066,996	20,469,294	18,417,781	18,469,568	14,989,695
Massachusetts	16,786,577	16,295,373	16,234,037	16,030,807	12,722,974
Michigan	130,860,609	124,029,572	123,825,527	151,975,563	111,405,530
Minnesota	118,361,306	102,972,753	108,274,963	136,349,610	103,931,377
Mississippi	1,882,986	2,553,633	2,634,347	2,572,616	1,774,621
Missouri	90,003,537	75,890,415	74,981,382	78,948,484	69,074,500
Montana	79,766,380	68,264,687	74,752,309	93,842,135	50,995,123
Nebraska	3,322,460	3,541,792	3,454,700	4,844,542	4,962,012
Nevada	27,613,232	26,753,295	34,881,787	36,775,743	24,075,375
New Hampshire	4,144,645	3,447,105	3,816,065	3,725,951	3,337,169
New Jersey	77,065,713	73,090,810	70,865,363	71,891,861	57,206,357
New Mexico	28,513,991	28,608,776	30,426,840	37,127,621	31,850,263
New York	112,016,262	112,209,533	108,025,720	109,361,349	99,622,368
North Carolina	10,992,793	11,703,671	11,480,406	10,963,896	7,462,450
North Dakota	2,804,837	2,869,663	3,082,621	3,465,563	3,056,493
Ohio	253,883,995	226,962,529	211,041,279	220,061,343	186,971,555
Oklahoma	569,518,693	524,594,732	486,634,347	516,685,232	390,170,991
Oregon	6,941,355	6,821,224	6,686,988	6,876,703	6,169,898
Pennsylvania	1,055,766,077	936,773,189	881,490,033	892,913,833	778,523,421
Rhode Island	1,339,398	1,310,756	830,742	939,602	1,209,227
South Carolina	3,677,209	4,251,137	4,045,849	3,592,112	3,341,051
South Dakota	7,595,358	8,463,952	9,443,488	8,914,344	11,075,808
Tennessee	39,296,668	37,874,981	39,216,757	40,719,706	32,499,380
Texas	420,586,730	374,503,420	378,616,955	495,819,500	450,373,151
Utah	98,985,218	90,388,455	97,381,148	115,131,131	64,224,307
Vermont	14,955,161	14,702,891	14,648,737	14,602,589	11,637,393
Virginia	46,136,458	41,322,998	38,770,281	39,752,683	34,602,749
Washington	21,256,952	21,965,917	22,119,541	22,435,359	20,075,844
West Virginia	395,941,940	366,643,205	336,636,948	346,564,746	290,118,914
Wisconsin	20,711,736	21,776,847	20,938,179	24,222,229	17,711,394
Wyoming	78,988,066	56,166,600	52,950,875	51,237,407	46,735,184

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[1] In this table iron ore, not pig iron, is taken as the basis of valuation of iron, and in the case of other metals mine production (recoverable content of metals) is the basis.

Mineral products of the United States and principal producing States in 1930

Rank in value	Product	Principal producing States [1]	
		In order of quantity	In order of value
15	Aluminum	New York, Tennessee, North Carolina	Rank same as for quantity.
49	Antimonial lead	Not separable by States	Not separable by States.
55	Arsenious oxide	Montana, Utah	Rank same as for quantity.
64	Asbestos	Vermont, Arizona, Georgia, Maryland	Arizona, Vermont, Georgia, Maryland.
	Asphalt:		
32	Native	Kentucky, Texas, Utah, Oklahoma	Kentucky, Utah, Texas, Oklahoma.
22	Oil	Not separable by States	Not separable by States.
47	Barite (crude)	Missouri, Georgia, California, Tennessee	Rank same as for quantity.
45	Bauxite	Arkansas, Georgia, Alabama	Arkansas, Alabama, Georgia.
61	Bismuth	Not separable by States	Not separable by States.
31	Borates	California	Rank same as for quantity.
28	Briquets, fuel	Wisconsin, Pennsylvania, West Virginia, Oregon	Wisconsin, Pennsylvania, Oregon, West Virginia.
40	Bromine	Michigan, California, West Virginia, Ohio	Rank same as for quantity.
41	Cadmium (metal and compounds)	Not separable by States	Not separable by States.
39	Calcium-magnesium chloride	Michigan, California, West Virginia, Ohio	Michigan, West Virginia, California, Ohio.
6	Cement	Pennsylvania, Michigan, New York, California	Pennsylvania, New York, California, Michigan.
60	Chats	Missouri, Oklahoma, Kansas	Rank same as for quantity.
85	Chromite	California	Do.
5	Clay products		Ohio, Pennsylvania, New Jersey, Illinois.
26	Clay, raw	Pennsylvania, California, Ohio, Missouri	Georgia, Pennsylvania, Missouri, California.
1	Coal:		
	Bituminous	Pennsylvania, West Virginia, Illinois, Kentucky	Rank same as for quantity.
	Pennsylvania anthracite	Pennsylvania	Do.
7	Coke	Pennsylvania, Ohio, Indiana, Alabama	Pennsylvania, Ohio, New York, Illinois.
84	Columbite	South Dakota, New Mexico	Rank same as for quantity.
8	Copper	Arizona, Montana, Utah, Michigan	Do.
38	Diatomite and tripoli	California, Illinois, Missouri, Oklahoma	California, Missouri, Illinois, Oklahoma.
82	Emery	New York	Rank same as for quantity.
51	Feldspar (crude)	North Carolina, Maine, New Hampshire, South Dakota	North Carolina, Maine, New Hampshire, California.
14	Ferro-alloys	Pennsylvania, New York, Ohio, Iowa	Pennsylvania, New York, Ohio, West Virginia.
76	Flint lining for tube mills	Minnesota	Rank same as for quantity.
46	Fluorspar	Illinois, Kentucky, Colorado, New Mexico	Do.
33	Fuller's earth	Georgia, Florida, Texas, Illinois	Do.
63	Garnet, abrasive	New York, New Hampshire	Do.
(2)	Gems and precious stones	No canvass for 1930	No canvass for 1930.
16	Gold	California, Alaska, South Dakota, Colorado	Rank same as for quantity.
77	Graphite		Alabama, Rhode Island, Michigan, Nevada.
	Amorphous	Rhode Island, Nevada, Michigan	Rhode Island, Michigan, Nevada.
	Crystalline	Alabama	Rank same as for quantity.

[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output.

[2] No canvass for 1930.

Mineral products of the United States and principal producing States in 1930—Continued

Rank in value	Product	Principal producing States	
		In order of quantity	In order of value
57	Grindstones and pulpstones	Ohio, West Virginia, Michigan, Illinois	West Virginia, Ohio, Michigan, Washington.
19	Gypsum	New York, Michigan, Iowa, Texas	Rank same as for quantity.
10	Iron ore	Minnesota, Michigan, Alabama, Wisconsin	Minnesota, Michigan, Alabama, New York.
3	Iron, pig	Pennsylvania, Ohio, Indiana, Illinois	Pennsylvania, Ohio, Illinois, Indiana.
13	Lead	Missouri, Idaho, Utah, Oklahoma	Rank same as for quantity.
20	Lime	Ohio, Pennsylvania, Missouri, West Virginia	Do.
74	Lithium minerals	South Dakota, New Mexico, California	Do.
52	Magnesite	Washington, California	Do.
66	Magnesium	Michigan	Do.
50	Magnesium salts (natural)	Michigan, California	Do.
48	Manganese ore	Montana, Georgia, Virginia, Arkansas	Do.
37	Manganiferous ore	Minnesota, Colorado, New Mexico, Arkansas	Minnesota, Georgia, Colorado, Arkansas.
67	Manganiferous zinc residuum	New Jersey	Rank same as for quantity.
	Marl:		
72	Calcareous	California, Virginia, West Virginia, North Carolina	California, West Virginia, Virginia, North Carolina.
68	Greensand	New Jersey	Rank same as for quantity.
36	Mercury	California, Nevada, Oregon, Texas	Do.
65	Mica	North Carolina, New Hampshire, New Mexico, South Dakota	North Carolina, New Hampshire, New Mexico, Connecticut.
	Scrap	North Carolina, New Mexico, New Hampshire, South Dakota	Rank same as for quantity.
	Sheet	North Carolina, New Hampshire, Georgia, Connecticut	North Carolina, New Hampshire, Connecticut, Georgia.
73	Micaceous minerals	North Carolina, Georgia, Montana, Colorado	Georgia, North Carolina, Montana, Colorado.
78	Millstones		New York, Virginia, North Carolina, New Hampshire.
24	Mineral paints, zinc and lead pigments	Pennsylvania, Ohio, Indiana, Illinois	Rank same as for quantity.
(1)	Mineral waters	No canvass for 1930	No canvass for 1930.
42	Molybdenum	Colorado, New Mexico	Rank same as for quantity.
4	Natural gas	Texas, Oklahoma, California, Louisiana	Texas, California, West Virginia, Oklahoma.
11	Natural gasoline	California, Oklahoma, Texas, Louisiana	California, Oklahoma, Texas, West Virginia.
69	Nickel	Not separable by States	Not separable by States.
70	Oilstones, etc	Vermont, Ohio, Arkansas, Indiana	Arkansas, Vermont, Ohio, Indiana.
(2)	Peat	No canvass for 1930	No canvass for 1930.
80	Pebbles for grinding	Minnesota, California	Rank same as for quantity.
2	Petroleum	Texas, California, Oklahoma, Kansas	Texas, Oklahoma, California, Kansas.
25	Phosphate rock	Florida, Tennessee, Idaho, Montana	Rank same as for quantity.
43	Platinum and allied metals	Alaska, California, Oregon	Do.
35	Potassium salts	California, Maryland, Nevada	Do.
62	Pumice	Kansas, California, Nebraska, Arizona	California, Kansas, Nebraska, South Dakota.
53	Pyrites	Tennessee, Virginia, California, New York	Tennessee, California, Virginia, New York.
21	Salt	Michigan, New York, Ohio, Kansas	Michigan, New York, Kansas, Ohio.
12	Sand and gravel	New York, Illinois, Ohio, California	New York, Pennsylvania, Illinois, Ohio.
44	Sand-lime brick	Michigan, New York, New Jersey, Massachusetts	Michigan, New York, Massachusetts, New Jersey.

59	Selenium	Not separable by States	Not separable by States.
71	Silica (quartz)	Wisconsin, North Carolina, California, Maryland	Wisconsin, North Carolina, California, Massachusetts.
54	Silica sand and sandstone (finely ground)	Illinois, New Jersey, West Virginia, Pennsylvania	West Virginia, Pennsylvania, Illinois, New Jersey.
23	Silver	Utah, Idaho, Montana, Arizona	Rank same as for quantity.
29	Slate		Pennsylvania, Vermont, Maine, Virginia.
30	Sodium salts (other than NaCl) from natural sources.	California, Arizona, Wyoming, Nevada	Rank same as for quantity.
9	Stone	Pennsylvania, Ohio, New York, California	Indiana, New York, Pennsylvania, Ohio.
18	Sulphur	Texas	Rank same as for quantity.
27	Sulphuric acid from copper and zinc smelters	Tennessee, Illinois, Pennsylvania, Montana	Do.
34	Talc and soapstone	New York, Vermont, Virginia, California	New York, Virginia, Vermont, California.
81	Tellurium	Not separable by States	Not separable by States.
79	Tin	Alaska, North Carolina, South Dakota	Rank same as for quantity.
	Titanium ore:		
83	Ilmenite	Virginia	Do.
75	Rutile	do	Do.
58	Tungsten ore	Nevada, California, Colorado, Montana	Do.
56	Uranium and vanadium ores	Colorado, Arizona, Utah	Do.
17	Zinc	Oklahoma, New Jersey, Kansas, Utah	Do.

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[2] No canvass for 1930.

States and their principal mineral products in 1930 [1]

State	Rank	Percentage of total value for United States	Principal mineral products in order of value
Alabama	19	1.50	Coal, iron ore, cement, clay products.
Alaska	34	.32	Gold, copper, coal, silver.
Arizona	13	1.94	Copper, gold, silver, stone.
Arkansas	23	.82	Petroleum, coal, natural gas, bauxite.
California	2	11.24	Petroleum, natural gas, natural gasoline, clay products.
Colorado	22	1.08	Coal, gold, zinc, clay products.
Connecticut	42	.13	Stone, clay products, sand and gravel, lime.
Delaware	50	.01	Stone, clay products, sand and gravel.
District of Columbia	48	.03	Sand and gravel, clay products, sand-lime brick, stone.
Florida	32	.36	Phosphate rock, stone, cement, fuller's earth.
Georgia	35	.30	Stone, clay products, fuller's earth, cement.
Idaho	29	.54	Lead, silver, zinc, stone.
Illinois	7	3.48	Coal, clay products, cement, petroleum.
Indiana	14	1.86	Coal, stone, cement, clay products.
Iowa	25	.78	Coal, cement, clay products, gypsum.
Kansas	11	2.35	Petroleum, natural gas, cement, zinc.
Kentucky	8	2.62	Coal, petroleum, natural gas, clay products.
Louisiana	15	1.69	Natural gas, petroleum, natural gasoline, sand and gravel.
Maine	40	.15	Stone, cement, sand and gravel, lime.
Maryland	33	.35	Coal, clay products, cement, sand and gravel.
Massachusetts	36	.30	Stone, sand and gravel, clay products, lime.
Michigan	9	2.61	Iron ore, copper, cement, salt.
Minnesota	10	2.44	Iron ore, stone, cement, sand and gravel.
Mississippi	47	.04	Sand and gravel, clay products, natural gas, stone.
Missouri	16	1.62	Lead, clay products, cement, coal.
Montana	20	1.20	Copper, coal, petroleum, natural gas.
Nebraska	43	.12	Cement, sand and gravel, clay products, stone.
Nevada	28	.56	Copper, gold, silver, zinc.
New Hampshire	45	.08	Stone, clay products, sand and gravel, feldspar.
New Jersey	18	1.34	Clay products, zinc, sand and gravel, cement.
New Mexico	27	.75	Petroleum, copper, coal, zinc.
New York	12	2.34	Stone, cement, clay products, sand and gravel.
North Carolina	39	.17	Stone, copper, clay products, feldspar.
North Dakota	46	.07	Coal, clay products, sand and gravel, natural gas.
Ohio	6	4.39	Clay products, natural gas, coal, stone.
Oklahoma	4	9.15	Petroleum, natural gas, natural gasoline, zinc.
Oregon	41	.14	Stone, cement, sand and gravel, clay products.
Pennsylvania	1	18.26	Coal, cement, natural gas, clay products.
Rhode Island	49	.03	Stone, sand and gravel, clay products, lime.
South Carolina	44	.08	Stone, clay products, sand and gravel, barite.
South Dakota	38	.26	Gold, sand and gravel, cement, stone.
Tennessee	26	.76	Coal, cement, stone, phosphate rock.
Texas	3	10.56	Petroleum, natural gas, sulphur, natural gasoline.
Utah	17	1.51	Copper, lead, coal, silver.
Vermont	37	.27	Stone, slate, lime, talc.
Virginia	24	.81	Coal, stone, zinc, clay products.
Washington	30	.47	Coal, cement, clay products, sand and gravel.
West Virginia	5	6.80	Coal, natural gas, clay products, petroleum.
Wisconsin	31	.42	Stone, iron ore, sand and gravel, clay products.
Wyoming	21	1.10	Petroleum, coal, natural gas, natural gasoline.

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[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and in the case of other metals mine production (recoverable content) of metals is the basis.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver [1]	Copper [2]	Lead [2]	Zinc [2]	Year	Silver [1]	Copper [2]	Lead [2]	Zinc [2]
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

[1] Average price furnished by Bureau of the Mint.

[2] Average price, all grades.

DETAILED TABLES

ABRASIVE MATERIALS

Natural abrasives sold by producers in the United States, 1921–1930 [1]

Year	Millstones [2]	Grindstones		Pulpstones [3]		Oilstones and scythestones		Emery	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	$24, 524	16, 310	$477, 259	10, 030	$750, 063	831	$173, 025	305	$2, 250
1922	20, 853	21, 367	574, 900	5, 157	445, 286	1, 016	197, 450	1, 468	17, 511
1923	22, 229	37, 384	1, 008, 899	9, 186	680, 416	1, 223	231, 812	2, 286	29, 478
1924	30, 125	28, 991	852, 260	9, 193	814, 409	1, 056	258, 943	2, 195	19, 756
1925	22, 490	28, 970	864, 637	8, 370	841, 302	970	272, 224	769	5, 907
1926	45, 937	28, 669	875, 240	9, 670	997, 994	1, 680	223, 359	386	3, 641
1927	35, 438	23, 222	633, 207	8, 709	921, 543	1, 048	233, 545	506	5, 855
1928	42, 886	24, 222	606, 408	9, 016	902, 429	956	228, 245	1, 341	16, 787
1929	31, 407	21, 071	617, 618	6, 665	623, 928	838	212, 017	924	10, 722
1930	17, 702	14, 559	423, 835	4, 141	346, 736	651	137, 184	555	5, 996

Year	Garnet		Diatomite		Tripoli (including rottenstone)			Pumice and pumicite		Grinding pebbles and tube-mill lining	
						Value					
	Short tons	Value	Short tons	Value	Short tons	Crude (estimated)	As sold (crude and finished)	Short tons	Value	Short tons	Value
1921	3, 048	$260, 687	[4] 55, 134	[4] $682, 616	12, 340	$53, 892	$213, 013	37, 108	$158, 540	989	$14, 637
1922	7, 054	566, 879	44, 761	386, 669	30, 205	105, 309	316, 728	45, 262	175, 600	3, 159	30, 798
1923	9, 006	688, 437	65, 833	699, 406	27, 082	62, 190	382, 757	56, 575	214, 169	4, 551	51, 795
1924	8, 290	674, 176	63, 163	693, 917	28, 476	55, 537	389, 409	43, 651	190, 253	2, 532	37, 429
1925	8, 429	712, 853	73, 030	922, 281	29, 388	58, 770	434, 886	40, 380	179, 020	3, 831	50, 147
1926	6, 397	523, 875	[4] 87, 126	[4] 1, 081, 564	31, 369	65, 022	523, 609	53, 887	208, 504	6, 219	85, 146
1927	6, 939	573, 525	(5)	(5)	26, 099	66, 452	447, 068	53, 298	221, 481	3, 342	46, 856
1928	6, 617	459, 307	(5)	(5)	34, 043	73, 689	555, 576	57, 430	278, 516	6, 288	89, 321
1929	5, 961	435, 420	(5)	(5)	38, 011	74, 475	545, 658	67, 013	353, 064	4, 630	66, 178
1930	5, 003	314, 129	(5)	(5)	32, 439	71, 790	507, 505	56, 843	336, 099	3, 480	50, 816

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[1] For figures on abrasive feldspar and quartz, see sections on feldspar and silica.

[2] Figures for quantity not available.

[3] Exclusive of sales in Washington prior to 1923.

[4] Partly estimated.

[5] Bureau of Mines not at liberty to publish figures.

Value of abrasive materials imported for consumption in the United States, 1921–1930

Material	1921	1922	1923	1924	1925
Millstones and burrstones	$13, 556	$15, 356	$20, 102	$6, 311	$8, 413
Grindstones	81, 880	81, 733	106, 028	122, 440	124, 319
Hones, oilstones, and whetstones	35, 761	48, 938	53, 233	43, 579	49, 108
Emery and corundum	393, 154	389, 390	722, 688	364, 755	313, 718
Garnet	(1)	[1] 1, 837	93, 803	54, 402	200
Diatomaceous earth, tripoli, and rottenstone	13, 203	10, 429	11, 779	9, 504	6, 589
Pumice	173, 201	118, 458	128, 693	111, 284	130, 460
Diamond:					
Dust and bort	466, 345	1, 029, 261	228, 409	259, 482	760, 476
Glaziers' and engravers', unset, and miners'	435, 872	839, 882	1, 065, 834	1, 116, 862	1, 976, 640
Flint, flints, and flint stones, unground	116, 157	145, 805	130, 974	114, 958	105, 041

Material	1926	1927	1928	1929	1930
Millstones and burrstones	$6, 266	$12, 726	$6, 354	$6, 564	$7, 050
Grindstones	120, 335	134, 804	114, 874	119, 264	66, 677
Hones, oilstones, and whetstones	63, 152	67, 368	45, 303	48, 207	40, 612
Emery and corundum	616, 700	264, 613	272, 533	494, 174	329, 752
Garnet			115		
Diatomaceous earth, tripoli, and rottenstone [2]	14, 544	15, 403	21, 883	23, 183	46, 478
Pumice	129, 449	124, 074	159, 430	143, 944	94, 387
Diamond:					
Dust and bort	271, 382	62, 045	31, 222	89, 363	90, 945
Glaziers' and engravers', unset, and miners'	1, 939, 735	2, 148, 275	2, 756, 895	4, 067, 674	2, 756, 630
Flint, flints, and flint stones, unground	120, 078	93, 658	144, 313	127, 457	62, 463

[1] Not separately recorded prior to change in tariff, Sept. 22, 1922.

[2] Beginning June 18, 1930, classification reads "Tripoli and rottenstone."

Value of domestic abrasive materials exported, 1921–1930

Material	1921	1922	1923	1924	1925
Grindstones	$281, 976	$281, 413	$499, 123	$481, 397	$553, 750
Abrasive wheels, emery, and other	1, 318, 804	644, 151	571, 733	521, 840	439, 904
All other natural abrasives, hones, whetstones, etc	1, 719, 810	292, 051	342, 737	173, 731	195, 915

Material	1926	1927	1928	1929	1930
Grindstones	$629, 748	$578, 113	$760, 975	$391, 239	$246, 512
Abrasive wheels, emery, and other	248, 631	240, 027	254, 493	286, 360	203, 371
All other natural abrasives, hones, whetstones, etc	323, 447	419, 088	453, 055	423, 363	361, 055

ALUMINUM

[See Bauxite and aluminum]

ANTIMONY AND ANTIMONIAL LEAD

Mine production of antimony ores in the United States, 1921–1930, in short tons [1]

Year	Ore	Antimony content	Year	Ore	Antimony content
1922	20	4	1925	123	33
1923	40	10	1926	99	43
1924	113	33	1928	86	42

[1] No production reported for 1921, 1927, 1929, and 1930.

Only two smelters reported production of metallic antimony in the United States in 1926 and 1927 and only one in 1925 and 1928; the Bureau of Mines is not at liberty to publish the figures. No production was reported for 1921 to 1924 and for 1929 and 1930. The total output in 1928 and part of that in 1926 came from domestic ore smelted.

Secondary antimony and antimony content of secondary alloys recovered from old alloys, scrap, and dross in the United States, 1921–1930

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1921	4, 720	$464, 400	1926	16, 230	$5, 164, 400
1922	7, 090	765, 700	1927	12, 400	3, 060, 300
1923	8, 021	1, 252, 800	1928	11, 900	2, 451, 400
1924	9, 404	2, 025, 600	1929	11, 131	1, 990, 200
1925	10, 840	3, 794, 000	1930	8, 082	1, 239, 800

[1] Values calculated at average yearly price for ordinary brands of antimony as published by the American Metal Market.

By-product antimonial lead produced in the United States from both foreign and domestic ores, 1921–1930

Year	Short tons	Value	Antimony content (short tons)	Year	Short tons	Value	Antimony content (short tons)
1921	10, 064	$870, 059	1, 589	1926	22, 524	$3, 916, 714	2, 693
1922	8, 075	844, 993	1, 441	1927	24, 347	3, 277, 043	2, 736
1923	14, 190	1, 950, 370	2, 170	1928	33, 058	3, 978, 318	3, 432
1924	20, 787	3, 376, 713	2, 763	1929	25, 669	3, 267, 095	3, 052
1925	19, 667	3, 785, 547	2, 624	1930	13, 711	1, 392, 524	1, 685

Antimony imported for consumption in the United States, 1921–1930

Year	Antimony ore			Liquated antimony sulphide		Metallic antimony		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1921	213	98	$11, 682	353	$17, 577	10, 130	$781, 146	154	$15, 558
1922	--------	--------	--------	689	40, 108	9, 344	659, 242	379	65, 538
1923	(1)	1, 047	44, 721	835	64, 493	6, 763	641, 804	2, 277	288, 206
1924	(1)	899	62, 999	558	52, 393	6, 778	840, 434	1, 207	190, 252
1925	1, 359	773	47, 084	760	115, 990	9, 857	2, 362, 915	1, 792	349, 990
1926	2, 497	1, 559	287, 258	2, 040	343, 705	11, 506	3, 144, 330	2, 259	517, 584
1927	3, 566	2, 015	282, 098	1, 077	134, 949	9, 891	2, 111, 411	1, 803	484, 873
1928	3, 912	2, 185	313, 127	1, 208	158, 231	9, 684	1, 641, 265	2, 643	448, 156
1929	3, 161	1, 865	231, 086	1, 803	174, 104	11. 073	1, 622, 182	2, 222	359, 247
1930	1, 461	863	91, 499	713	45, 806	7, 700	883, 448	783	119, 314

[1] Figures not available.

Foreign antimony (matte, regulus, or metal) exported from the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	290,776	$15,741	1926	367,942	$41,554
1922 [1]	37,218	1,548	1927	726,094	72,280
1923	15,958	1,047	1928	1,198,339	90,975
1924	279,920	14,441	1929	1,017,656	71,415
1925	158,970	17,376	1930	985,505	54,034

[1] During 1922 exports of "matte, regulus, or metal" of domestic manufacture were 224,010 pounds, valued at $14,941. This is the first export of domestic antimony of which there is any record. However, antimony manufactured in the United States from foreign ores and exported would be classed as domestic exports. Similar exports for 1923 to 1930 are not shown.

ARSENIC

White arsenic (refined and crude) sold by producers in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	4,786	$717,700	1926	11,805	$674,350
1922	10,027	1,475,229	1927	11,560	725,360
1923	14,271	2,808,801	1928	11,767	735,373
1924	14,453	2,655,015	1929	14,546	883,771
1925	12,317	1,199,247	1930	17,425	1,008,385

Arsenic compounds and metallic arsenic imported for consumption in the United States, 1921–1930

Year	Arsenious acid (white arsenic, As_2O_3)		Arsenic sulphide (realgar and orpiment)		Sheep dip		Paris green and London purple	
	Short tons	Value	Short tons	Value	Pounds	Value	Pounds	Value
1921	1,669	$253,250	3,343	$531,322	61,377	$6,362	325	$123
1922	1,081	162,494	3,815	472,044	70,390	4,877	3,866	741
1923	10,152	1,985,400	1,097	268,311	87,739	5,237	100,781	20,586
1924	8,877	1,597,433	234	45,246	114,801	10,764	76,241	15,683
1925	9,316	1,076,073	476	63,296	73,477	4,953	2,880	702
1926	7,703	510,227	283	40,718	119,947	14,070	4,747	1,011
1927	12,517	921,998	206	35,089	102,394	8,952	----------	----------
1928	11,153	775,169	263	51,278	175,055	17,592	13,279	1,497
1929	13,157	956,176	212	40,976	208,770	21,533	1,102	200
1930	10,471	725,991	277	47,235	174,215	18,517	19,024	1,595

Year	Arsenic acid (H_3AsO_4)		Calcium arsenate		Lead arsenate		Metallic arsenic	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1922 [2]	41,296	$4,195	----------	----------	----------	----------	22,487	$3,484
1923	166,354	15,597	----------	----------	26	$9	174,415	37,314
1924	420	121	3,172	$278	3,585	525	122,467	23,684
1925	59,112	2,676	1,074	135	10,467	1,514	149,018	31,918
1926	2,340	165	1,057	284	----------	----------	174,490	35,745
1927	11,685	470	3,807	717	----------	----------	245,686	47,875
1928	75	30	1,323	233	----------	----------	186,622	35,584
1929	247	26	----------	----------	200	26	287,545	50,730
1930	201	64	6,359	387	800	62	113,440	19,006

[1] Figures not available.

[2] Figures cover period Sept. 22 to Dec. 31. Not separately recorded prior to change in tariff.

Arsenic compounds exported from the United States, 1928–1930 [1]

Year	Calcium arsenate		Lead arsenate	
	Pounds	Value	Pounds	Value
1928	1, 178, 702	$67, 151	1, 093, 673	$141, 235
1929	3, 139, 633	171, 123	1, 563, 982	192, 185
1930	3, 177, 335	166, 647	2, 270, 980	263, 603

[1] Not separately recorded prior to 1928.

ASBESTOS

Asbestos sold by producers in the United States, 1921–1930, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	438	$313, 268	393	$23, 700	831	$336, 968
1922	25	3, 320	42	6, 800	67	10, 120
1923	69	4, 433	158	5, 193	227	9, 626
1924	173	33, 941	127	8, 585	300	42, 526
1925	93	40, 750	1, 165	10, 950	1, 258	51, 700
1926	(1)	(1)	(1)	(1)	1, 358	134, 731
1927	(1)	(1)	(1)	(1)	2, 981	336, 882
1928	(1)	(1)	(1)	(1)	2, 239	351, 178
1929	1, 983	317, 584	1, 172	33, 420	3, 155	351, 004
1930	3, 653	273, 292	589	15, 992	4, 242	289, 284

[1] Bureau of Mines not at liberty to publish figures.

Asbestos (unmanufactured) imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1921	72, 463	$2, 948, 302	520	$101, 600
1922	149, 427	5, 144, 700	376	49, 939
1923	212, 420	7, 445, 143	680	48, 525
1924	183, 250	5, 602, 945	1, 270	93, 163
1925	230, 520	7, 134, 302	1, 109	70, 846
1926	257, 621	8, 142, 505	1, 104	85, 922
1927	223, 693	8, 150, 340	309	48, 774
1928	230, 595	9, 017, 891	850	346, 632
1929	262, 427	11, 153, 017	709	108, 467
1930	208, 681	7, 064, 824	771	95, 318

ASPHALT AND RELATED BITUMENS

Native asphalt and related bitumens sold at mines in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	296, 412	$1, 985, 583	1926	715, 180	$4, 484, 960
1922	327, 792	2, 253, 180	1927	839, 040	5, 605, 850
1923	400, 236	2, 885, 631	1928	807, 860	5, 175, 055
1924	562, 367	3, 958, 339	1929	804, 027	5, 470, 493
1925	584, 850	4, 148, 400	1930	702, 777	4, 463, 092

Asphalt (including road oil), manufactured in the United States from petroleum, sold at refineries in 1921–1930

Year	From domestic petroleum		From foreign petroleum	
	Short tons	Value	Short tons	Value
1921	624, 220	$9, 048, 221	908, 093	$11, 761, 358
1922	805, 145	10, 385, 925	1, 242, 163	13, 899, 407
1923	995, 654	13, 060, 174	1, 378, 722	16, 840, 045
1924	1, 158, 456	14, 305, 007	1, 920, 915	21, 710, 793
1925	1, 206, 700	15, 305, 760	1, 971, 670	27, 520, 010
1926	1, 245, 160	15, 452, 940	2, 213, 310	31, 098, 460
1927	1, 525, 420	19, 019, 150	2, 426, 030	35, 771, 940
1928	1, 930, 536	22, 060, 312	2, 298, 848	30, 056, 866
1929	2, 332, 973	24, 135, 787	2, 355, 498	27, 057, 868
1930	2, 273, 546	21, 570, 439	1, 986, 926	21, 181, 467

Asphalt and related bitumens imported for consumption in the United States, 1921–1930

Year	Crude asphalt		Ozokerite	
	Short tons	Value	Short tons	Value
1921	116, 450	$972, 166	4, 274	$546, 054
1922	120, 359	940, 873	4, 495	371, 161
1923	138, 430	1, 046, 603	2, 428	213, 407
1924	156, 662	1, 165, 253	1, 557	207, 833
1925	113, 384	823, 165	3, 088	361, 767
1926	140, 746	1, 025, 629	4, 144	479, 957
1927	157, 982	1, 138, 898	3, 800	579, 118
1928	119, 560	864, 607	5, 451	594, 416
1929	121, 019	955, 606	4, 896	616, 617
1930	53, 198	457, 172	6, 237	722, 426

Year	Ichthyol		Bituminous limestone		Total	
	Pounds	Value	Short tons	Value	Short tons	Value
1921	76, 020	$107, 752	12, 085	$157, 124	132, 847	$1, 783, 096
1922	74, 330	89, 150	4, 300	59, 590	129, 191	1, 460, 774
1923	[1] 20	15	6, 205	33, 303	147, 063	1, 293, 328
1924	9, 300	17, 058	3, 354	37, 906	161, 578	1, 428, 050
1925	560	1, 281	8, 778	84, 259	125, 250	1, 270, 472
1926	25, 396	34, 385	1, 886	19, 967	146, 789	1, 559, 938
1927	48, 199	58, 821	118	1, 500	161, 924	1, 778, 337
1928	42, 610	60, 321	28	439	125, 060	1, 519, 783
1929	32, 529	42, 066	-----------	-----------	125, 931	1, 614, 289
1930	20, 980	29, 272	-----------	-----------	59, 445	1, 208, 870

[1] As recorded by Bureau of Foreign and Domestic Commerce. Reclassification after change in tariff, Sept. 22, 1922, may account to some extent for great decrease.

Asphalt and related bitumens exported from the United States, 1921–1930

Year	Native asphalt				Petroleum asphalt	
	Unmanufactured		Manufactures of	Total value	Short tons	Value
	Short tons	Value				
1921	45,367	$1,178,038	$621,224	$1,799,262	(1)	(1)
1922	57,362	1,344,440	[2] 1,261,125	2,605,565		
1923	72,628	1,500,869	[2] 2,075,628	3,576,497		
1924	52,568	1,245,670	[2] 2,212,260	3,457,930		
1925	32,835	825,654	[2] 2,525,618	3,351,272	89,014	$1,762,048
1926	38,218	905,743	[2] 2,189,808	3,095,551	146,589	3,183,746
1927	39,875	1,034,334	[2] 2,399,700	3,434,034	385,031	8,325,413
1928	26,263	683,563	[2] 2,022,251	2,705,814	492,362	9,788,501
1929	46,962	1,133,058	[2] 2,382,260	3,515,318	479,404	8,542,975
1930	23,160	628,673	[2] 1,808,453	2,437,126	410,389	7,277,032

[1] Exports of petroleum asphalt not separately recorded prior to 1925.

[2] Inclusive of value of squares (10 by 10 feet) of roofing asphalt as follows: 1922, 588,636 squares, $870,200; 1923, 783,028 squares, $1,124,491; 1924, 697,293 squares, $998,469; 1925, 661,662 squares, $919,977; 1926, 938,176 squares, $1,212,409; 1927, 853,842 squares, $1,150,722; 1928, 934,908 squares, $1,251,429; 1929, 829,066 squares, $1,102,192; 1930, 543,426 squares, $688,362. Corresponding exports not separately shown prior to 1922.

BARITE AND BARIUM PRODUCTS

BARITE

Crude barite sold or used by producers in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	66,369	$531,958	1926	237,875	$1,773,293
1922	155,040	1,123,950	1927	254,265	1,670,878
1923	214,183	1,664,156	1928	269,544	1,754,924
1924	196,332	1,540,744	1929	277,269	1,850,706
1925	228,063	1,703,097	1930	234,932	1,538,171

Crude barite sold or used by producers in the United States, 1929 and 1930, by States

State	1929		1930	
	Short tons	Value	Short tons	Value
California	24,701	$147,762	19,517	$114,310
Georgia	94,118	546,212	41,746	230,769
Missouri	118,679	880,319	132,640	938,812
Nevada	818	6,384	2,647	19,457
Tennessee	26,140	181,725	17,006	111,981
Virginia	12,813	88,304	10,250	73,168
Other States [1]			11,126	49,674
	277,269	1,850,706	234,932	1,538,171

[1] South Carolina and Wisconsin.

Crude domestic and foreign barite used in the manufacture of barium products in the United States, 1921–1930, in short tons

Year	In manufacture of—		
	Ground barite	Lithopone	Barium chemicals
1921	28, 296	61, 359	10, 952
1922	48, 280	94, 259	25, 303
1923	47, 713	128, 547	34, 327
1924	42, 855	137, 127	33, 181
1925	56, 851	146, 693	29, 141
1926	69, 048	178, 889	33, 119
1927	73, 119	222, 791	34, 280
1928	74, 814	211, 592	48, 289
1929	58, 770	223, 188	52, 448
1930	69, 426	178, 944	76, 825

Crude barite imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	11, 054	$59, 371	1926	51, 016	$195, 004
1922	23, 239	104, 680	1927	70, 274	253, 284
1923	15, 045	93, 721	1928	61, 765	190, 756
1924	21, 502	104, 264	1929	85, 729	284, 436
1925	28, 655	91, 016	1930	52, 111	179, 579

Exports of barite are not separately recorded.

BARIUM PRODUCTS

Barium products, manufactured in the United States from either domestic or imported crude ore, sold or used by producers in 1921–1930, in short tons [1]

Product	1921	1922	1923	1924	1925
Ground barite	27, 661	46, 176	39, 605	38, 296	49, 674
Lithopone	55, 016	83, 360	98, 199	109, 469	145, 019
Barium chemicals:					
Carbonate	1, 956	2, 281	6, 362	6, 058	4, 962
Chloride	(2)	2, 022	3, 301	3, 859	(2)
Sulphate (blanc fixe)	2, 471	7, 349	6, 761	7, 796	11, 748
Other [3]	1, 060	2, 249	379	441	1, 944
	88, 164	143, 437	154, 607	165, 919	213, 347

Product	1926	1927	1928	1929	1930
Ground barite	57, 812	57, 658	64, 425	54, 472	55, 284
Lithopone	159, 931	176, 994	200, 468	206, 315	164, 065
Barium chemicals:					
Carbonate	5, 394	5, 969	7, 626	7, 902	5, 224
Chloride	4, 592	3, 708	5, 224	6, 545	(2)
Sulphate (blanc fixe)	(2)	13, 395	(2)	(2)	(2)
Other [3]	11, 925	871	21, 119	23, 991	26, 139
	239, 654	258, 595	298, 862	299, 225	250, 712

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[1] In order to avoid duplication of figures, barium chemicals manufactured from other barium chemicals bought in open market are not included in table.

[2] Included under "Other."

[3] Figures cover chemicals, as follows—1921 and 1925: Chloride, hydroxide, and sulphide; 1922: Binoxide, hydroxide, sulphide, and sulphydrate; 1923 and 1924: Hydroxide and sulphide; 1926: Hydroxide, sulphate, and sulphide; 1927: Binoxide, hydroxide, and sulphide; 1928 and 1929: Binoxide, hydroxide, sulphate, and sulphide; 1930: Binoxide, chloride, hydroxide, monoxide, oxide crystals, sulphate, and sulphide.

Barium products imported for consumption in the United States, 1921–1930

Year	Ground barite		Lithopone		Barium binoxide		Blanc fixe (precipitated barium sulphate)		Artificial barium carbonate (chemically precipitated)	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	1, 002	$16, 942	5, 247	$432, 019	669	$127, 631	769	$22, 470	2, 238	$80, 603
1922	4, 696	59, 453	10, 763	885, 671	1, 009	189, 334	2, 187	76, 445	5, 212	210, 250
1923	6, 022	88, 741	10, 440	776, 383	905	152, 270	587	32, 063	1, 901	79, 482
1924	2, 830	38, 292	6, 830	543, 025	860	120, 374	1, 047	50, 465	3, 752	128, 217
1925	3, 203	40, 008	6, 330	478, 395	635	70, 553	1, 996	81, 439	7, 188	160, 164
1926	3, 347	44, 781	8, 686	661, 700	49	8, 157	2, 973	136, 697	9, 224	189, 167
1927	3, 259	38, 568	7, 979	656, 166	6	1, 264	2, 400	107, 179	4, 918	119, 014
1928	3, 098	33, 378	9, 885	808, 200	6	1, 310	3, 680	168, 923	5, 222	116, 241
1929	2, 924	34, 619	8, 409	725, 554	(1)	21	3, 501	168, 367	3, 206	69, 236
1930	2, 331	26, 905	7, 018	595, 597	(2)	28	2, 994	133, 260	2, 662	52, 427

Year	Natural barium carbonate (ground witherite)		Barium chloride		Barium nitrate		Barium hydroxide	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	668	$25, 188	2, 186	$72, 621	(3)	(3)	(3)	(3)
1922	1, 472	39, 114	1, 962	112, 785	[4] 179	[4] $16, 795	[4] 73	[4] $6, 573
1923	1, 557	41, 823	1, 278	75, 014	511	59, 766	181	16, 872
1924	2, 500	56, 415	2, 330	100, 810	513	54, 638	174	8, 241
1925	2, 390	63, 634	2, 167	67, 306	703	58, 192	120	5, 605
1926	3, 380	80, 679	1, 773	49, 426	602	49, 494	236	9, 789
1927	3, 300	65, 821	1, 577	45, 285	711	65, 284	222	12, 439
1928	4, 311	82, 434	1, 172	25, 253	789	69, 010	186	10, 031
1929	4, 376	99, 335	78	3, 049	615	56, 770	202	11, 809
1930	2, 562	52, 282	7	372	407	31, 985	220	12, 235

[1] 133 pounds.
[2] 222 pounds.
[3] Not separately recorded prior to change in tariff, Sept. 22, 1922.
[4] Sept. 22 to Dec. 31.

Prior to 1922 barium products had not been exported in appreciable quantity, and no separate record of the exports was kept. Exports of lithopone have been as follows:

Lithopone exported from the United States, 1922–1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1922	1, 616	$169, 982	1927	2, 110	$222, 585
1923	1, 485	176, 624	1928	3, 326	337, 565
1924	923	104, 783	1929	4, 556	463, 235
1925	1, 287	132, 771	1930	3, 665	380, 047
1926	1, 941	200, 412			

[1] Not separately recorded prior to 1922.

BAUXITE AND ALUMINUM

BAUXITE

Bauxite produced in the United States, 1921–1930

Year	Georgia, Alabama, and Tennessee		Arkansas		Total	
	Long tons	Value	Long tons	Value	Long tons	Value
1921	14, 700	$134, 400	124, 850	$755, 400	139, 550	$889, 800
1922	42, 810	329, 440	266, 790	1, 682, 890	309, 600	2, 012, 330
1923	28, 810	176, 030	493, 880	2, 980, 580	522, 690	3, 156, 610
1924	19, 940	156, 990	327, 630	1, 981, 000	347, 570	2, 137, 990
1925	20, 220	109, 800	296, 320	1, 878, 450	316, 540	1, 988, 250
1926	20, 680	116, 650	371, 570	2, 298, 550	392, 250	2, 415, 200
1927	17, 110	95, 920	303, 830	1, 892, 860	320, 940	1, 988, 780
1928	14, 190	80, 668	361, 236	2, 193, 230	375, 426	2, 273, 898
1929	14, 723	84, 480	351, 054	2, 181. 158	365, 777	2, 265, 638
1930	15, 339	104, 908	315, 273	1, 823, 389	330, 612	1, 928, 297

Bauxite imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports (including bauxite concentrates)	
	Long tons	Value	Long tons	Value
1921	27, 587	$164, 589	5, 942	$488, 785
1922	23, 656	93, 805	19, 617	961, 208
1923	119, 020	593, 882	78, 560	3, 380, 486
1924	201, 974	909, 493	77, 065	3, 979, 832
1925	353, 696	1, 549, 120	78, 633	4, 134, 455
1926	281, 644	1, 187, 497	87, 770	4, 741, 260
1927	356, 580	1, 572, 236	121, 858	7, 800, 491
1928	350, 111	1, 534, 498	112, 984	5, 210, 912
1929	380, 812	1, 753, 840	133, 551	3, 926, 283
1930	409, 678	1, 995, 941	104, 504	3, 776, 774

ALUMINUM

Aluminum produced in the United States, 1921–1930

Year	Primary metal		Secondary metal[1]	
	Pounds	Value	Pounds	Value
1921	55, 000, 000	$10, 906, 000	17, 800, 000	$3, 775, 400
1922	74, 000, 000	13, 622, 000	32, 580, 000	6, 085, 900
1923	129, 000, 000	28, 305, 000	42, 600, 000	10, 824, 600
1924	150, 000, 000	37, 607, 000	54, 000, 000	14, 596, 200
1925	140, 000, 000	36, 430, 000	88, 000, 000	24, 816, 000
1926	145, 000, 000	37, 583, 000	88, 400, 000	23, 868, 000
1927	160, 000, 000	39, 266, 000	92, 400, 000	23, 469, 600
1928	210, 000, 000	47, 899, 000	95, 600, 000	22, 848, 400
1929	225, 000, 000	51, 864, 000	96, 800, 000	23, 135, 200
1930	229, 035, 000	50, 961, 000	77, 200, 000	17, 177, 000

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[1] Value of secondary aluminum, 1921–1929, inclusive, based on average price at New York, as given by American Metal Market.

Aluminum imported for consumption in the United States, 1921–1930

Year	Crude and semicrude [1]		Manufactures of [2]	Total value
	Pounds	Value		
1921	32,559,017	$7,627,508	$1,262,283	$8,889,791
1922	43,891,933	8,286,819	1,408,193	9,695,012
1923	42,476,789	8,316,816	425,747	8,742,563
1924	31,809,941	6,859,785	285,251	7,145,036
1925	41,997,178	9,805,645	301,122	10,106,767
1926	71,391,717	16,421,905	357,472	16,779,377
1927	62,575,222	13,316,986	884,992	14,201,978
1928	38,847,007	8,057,107	816,368	8,873,475
1929	50,880,823	9,934,723	925,286	10,860,009
1930	25,461,179	4,689,521	596,063	5,285,584

[1] Includes crude aluminum, plates, sheets, wire, etc.
[2] Includes aluminum leaf, kitchen utensils, and all other manufactures of aluminum.

Aluminum exported from the United States, 1921–1930

Year	Crude and semicrude [1]		Manufactures of	Total value
	Pounds	Value		
1921	2,196,378	$801,075	$2,307,782	$3,108,857
1922	4,347,020	1,127,460	[2] 1,708,656	2,836,116
1923	5,539,671	1,517,562	[2] 2,053,977	3,571,539
1924	6,343,512	1 632,315	[2] 2,540,075	4,172,390
1925	12,642,034	3,365,815	[2] 2,691,256	6,057,071
1926	7,634,171	2,135,087	[3] 2,317,216	4,452,303
1927	14,522,560	3,478,649	[3] 2,828,772	6,307,421
1928	15,728,281	3,758,728	[3] 3,132,762	6,891,490
1929	17,032,117	4,149,539	[3] 3,821,546	7,971,085
1930	17,329,511	3,915,582	[3] 3,206,272	7,121,854

[1] Includes ingots, metal and alloys, plates and sheets, etc.
[2] Represents value of 4,544,949 pounds in 1922, 5,402,034 pounds in 1923, 6,783,240 pounds in 1924, and 6,463,192 pounds in 1925 of tubes, moldings, castings, and other shapes, table, kitchen, or hospital utensils, and other manufactures. Figures of quantity not available prior to 1922.
[3] Tubes, moldings, castings, and other shapes exported amounted to 2,115,274 pounds in 1926, 1,529,615 pounds in 1927, 1,003,957 pounds in 1928, 2,466,508 pounds in 1929, and 1,864,308 pounds in 1930; figures for quantity of table, kitchen, or hospital utensils, and other manufactures exported are not recorded.

BISMUTH

The bismuth produced in the United States is a by-product obtained in the refining of lead and tin bullion, part of which is from ores of foreign origin. Figures of production are not available for publication.

Bismuth and "compounds, mixtures, and salts of bismuth" imported for consumption in the United States, 1921–1930

Year	Bismuth		Compounds, mixtures, and salts of bismuth	
	Pounds	Value	Pounds	Value
1921	94,085	$114,891	(1)	(1)
1922	121,505	239,777	[1] 9,392	[1] $8,681
1923	62,640	146,178	11,731	13,717
1924	18,494	39,653	10,066	12,533
1925	99,694	187,340	16,933	18,958
1926	67,505	173,285	12,864	18,864
1927	47,732	100,773	10,560	15,080
1928	41,383	77,444	8,168	16,336
1929	37,480	58,853	3,552	16,645
1930	24,405	20,088	657	5,083

[1] Not separately recorded prior to change in tariff, Sept. 22, 1922.

Exports of bismuth are not separately recorded.

BORAX

[See Sodium salts (natural)]

BRIQUETS (FUEL)

Fuel briquets produced in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	398, 949	$3, 632, 301	1926	995, 332	$8, 533, 179
1922	619, 425	5, 444, 926	1927	970, 468	7, 985, 165
1923	696, 810	5, 898, 698	1928	947, 423	7, 705, 617
1924	580, 470	4, 986, 622	1929	1, 212, 415	9, 515, 205
1925	839, 370	7, 128, 404	1930	1, 028, 865	8, 028, 736

Briquets and other composition coals for fuels imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	66	$251	1926	123, 593	$736, 804
1922	34, 862	139, 382	1927	60, 601	314, 435
1923	19, 559	103, 201	1928	71, 485	353, 168
1924	38	443	1929	89, 458	458, 517
1925	6, 758	43, 931	1930	73, 418	399, 146

BROMINE

Bromine and bromine in compounds sold or used by producers in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	711, 953	$172, 759	1926	1, 245, 760	$426, 837
1922	1, 005, 174	150, 668	1927	1, 756, 310	564, 689
1923	842, 352	146, 176	1928	2, 164, 000	649, 475
1924	2, 033, 804	594, 685	1929	6, 414, 620	1, 759, 325
1925	1, 566, 120	488, 406	1930	8, 462, 800	2, 109, 974

Bromine imported for consumption in the United States, 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	300	$84	1925	8, 009	$2, 110
1922	1, 094	339	1926	37, 839	14, 486
1923	782	1, 171	1929	17, 573	5, 804
1924	37, 318	8, 958	1930	1, 123	347

[1] No imports recorded for 1927 and 1928.

Exports are not specifically shown.

CADMIUM

Cadmium produced in the United States, 1921–1930

Year	Metallic cadmium		Cadmium compounds	
	Pounds	Value	Estimated cadmium content (pounds)	Value
1921	68,501	$67,131	[1] 49,100	[1] $71,336
1922	131,590	143,433	[1] 101,100	[1] 152,295
1923	183,816	161,758	(2)	(2)
1924	129,328	77,597	(2)	(2)
1925	502,824	276,553	113,000	127,304
1926	810,428	429,527	166,600	130,483
1927	1,074,654	[3] 645,000	229,000	191,051
1928	1,875,896	1,144,297	239,900	228,013
1929	2,481,427	2,009,956	433,300	498,734
1930	2,777,762	1,777,768	316,300	323,718

[1] Cadmium sulphide only.
[2] Bureau of Mines not at liberty to publish figures.
[3] Value in 1927 based on the average market quotation of 60 cents a pound.

Metallic cadmium imported for consumption in the United States, 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	101	$216	1927	22,400	$13,172
1922	2,240	2,434	1928	233,101	128,901
1923	16	119	1929	214,307	184,527
1924	1,102	743	1930	40,105	27,915
1925	5	6			

[1] No imports reported for 1926.

Exports of cadmium are not separately recorded.

CALCIUM CHLORIDE

Calcium-magnesium chloride, from natural brines, sold by producers in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	23,672	$510,723	1926	82,340	$1,710,405
1922	33,067	571,326	1927	95,721	1,947,797
1923	44,961	663,384	1928	102,090	1,995,603
1924	58,791	1,164,848	1929	114,240	2,097,061
1925	67,870	1,386,639	1930	116,160	2,207,800

Calcium chloride imported for consumption in the United States, 1922–1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1922 (Sept. 22 to Dec. 31)	740	$8,563	1927	6,514	$85,456
1923	3,232	48,527	1928	9,263	100,223
1924	3,996	54,542	1929	8,236	113,573
1925	2,253	37,121	1930	6,641	95,921
1926	7,372	96,742			

[1] Not separately recorded prior to change in tariff, Sept. 22, 1922.

Exports of calcium chloride were not separately recorded until 1929, when 15,425 short tons, valued at $362,658, were exported. Similar exports in 1930 were 21,350 tons, $513,577.

CARBON BLACK

Carbon black produced from natural gas in the United States, 1921–1930

Year	Number of producers reporting	Carbon black produced		Natural gas used (estimate)
		Pounds	Value at plant	M cubic feet
1921	23	59, 766, 315	$5, 445, 878	50, 565, 000
1922	26	67, 795, 129	5, 819, 618	53, 629, 000
1923	47	138, 262, 648	11, 692, 066	109, 096, 000
1924	46	186, 872, 034	11, 564, 936	156, 514, 000
1925	42	177, 417, 378	9, 639, 585	140, 366, 000
1926	33	180, 576, 176	9, 939, 221	130, 321, 000
1927	33	198, 429, 000	10, 955, 000	144, 087, 000
1928	31	248, 790, 000	13, 782, 000	175, 137, 000
1929	35	366, 442, 000	18, 720, 000	261, 107, 000
1930	33	379, 942, 000	14, 852, 000	266, 625, 000

No carbon black is imported.

Carbon black exported from the United States, 1925–1930 [1]

Year	Pounds	Value
1925	43, 182, 635	$3, 555, 769
1926	39, 210, 389	3, 622, 907
1927	54, 430, 811	4, 599, 734
1928	77, 903, 153	$6, 794, 224
1929	91, 829, 215	8, 270, 837
1930	84, 260, 447	5, 789, 458

[1] Not separately recorded prior to 1925.

CEMENT

Principal hydraulic cements shipped from mills in the United States, 1921–1930

Year	Masonry, natural, and puzzolan cements		Portland cement		Total	
	Barrels	Value	Barrels	Value	Barrels	Value
1921	539, 402	$897, 025	95, 507, 147	$180, 778, 415	96, 046, 549	$181, 675, 440
1922	889, 428	1, 293, 598	117, 701, 216	207, 170, 430	118, 590, 644	208, 464, 028
1923	1, 271, 674	1, 947, 352	135, 912, 118	257, 684, 424	137, 183, 792	259, 631, 776
1924	1, 418, 461	2, 006, 559	146, 047, 549	264, 046, 708	147, 466, 010	266, 053, 267
1925	1, 751, 725	2, 551, 583	157, 295, 212	278, 524, 108	159, 046, 937	281, 075, 691
1926	2, 031, 851	2, 820, 110	162, 187, 090	277, 965, 473	164, 218, 941	280, 785, 583
1927	2, 158, 323	2, 881, 029	171, 864, 728	278, 854, 647	174, 023, 051	281, 735, 676
1928	2, 213, 645	2, 910, 097	175, 838, 332	275, 972, 945	178, 051, 977	278, 883, 042
1929	2, 159, 130	2, 950, 717	169, 868, 322	252, 153, 789	172, 027, 452	255, 104, 506
1930	1, 787, 016	2, 469, 531	159, 059, 334	228, 779, 756	160, 846, 350	231, 249, 287

Portland cement produced in the United States, 1921–1930, in barrels

1921	98, 842, 049
1922	114, 789, 984
1923	137, 460, 238
1924	149, 358, 109
1925	161, 658, 901
1926	164, 530, 170
1927	173, 206, 513
1928	176, 298, 846
1929	170, 646, 036
1930	161, 197, 228

Portland cement produced, shipped, and in stock in the United States, 1929 and 1930, by States and districts

	Production				Shipments				Stock at mills (Dec. 31) (barrels)	
	Active plants		Barrels		1929		1930		1929	1930
	1929	1930	1929	1930	Barrels	Value	Barrels	Value		
STATE										
Alabama	6	6	5,005,967	4,821,141	5,228,947	$5,911,031	4,689,516	$5,829,818	522,058	653,683
California	12	12	13,091,899	10,124,219	12,964,746	22,805,576	10,438,479	15,241,089	1,077,385	763,125
Illinois	4	4	8,242,725	7,934,563	7,738,208	11,134,538	7,951,680	10,519,162	1,201,958	1,184,841
Iowa	6	6	6,373,330	7,088,108	6,586,111	9,781,159	7,035,252	10,107,584	1,347,144	1,400,000
Kansas	7	7	6,739,741	6,012,360	6,855,861	10,041,282	5,633,098	8,254,416	795,512	1,174,774
Michigan	14	14	13,748,862	11,510,895	13,325,727	18,916,711	10,817,994	14,897,439	2,403,185	3,096,086
Missouri	5	5	8,113,304	7,808,543	7,984,337	11,557,905	8,030,528	11,470,751	1,025,837	803,852
New York	10	10	10,761,368	10,372,742	10,742,992	15,597,868	10,256,086	15,380,703	1,523,266	1,639,922
Ohio	10	10	9,427,084	8,632,062	9,144,085	13,427,778	8,185,077	11,956,038	1,357,074	1,804,059
Pennsylvania	27	27	39,354,470	37,843,662	39,309,662	55,600,953	37,968,647	52,712,176	6,010,685	5,885,700
Tennessee	6	6	4,442,249	3,874,549	4,537,601	5,576,235	3,822,598	5,315,693	475,566	527,517
Texas	9	9	7,374,428	6,781,502	7,083,572	11,805,779	6,792,346	10,782,444	812,771	801,927
Other States[1]	47	47	37,970,609	38,392,882	38,366,473	59,996,974	37,438,033	56,312,443	5,148,092	6,102,941
	163	163	170,646,036	161,197,228	169,868,322	252,153,789	159,059,334	228,779,756	23,700,533	25,838,427
DISTRICT										
Eastern Pennsylvania, New Jersey, and Maryland	25	25	37,726,967	35,140,880	37,647,014	53,042,469	35,356,917	49,041,368	5,251,826	5,035,789
New York and Maine	11	11	11,418,596	11,341,724	11,519,619	16,780,423	11,121,958	16,877,560	1,554,615	1,774,381
Ohio, western Pennsylvania, and West Virginia	19	19	17,936,179	17,620,488	17,737,226	25,922,200	17,068,119	24,395,914	3,034,638	3,587,007
Michigan	14	14	13,748,862	11,510,895	13,325,727	18,916,711	10,817,994	14,897,439	2,403,185	3,096,086
Wisconsin, Illinois, Indiana, and Kentucky	11	11	21,378,418	20,232,671	21,171,227	31,168,394	19,571,759	26,995,982	2,942,727	3,603,639
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	19	19	13,792,618	12,880,818	14,047,259	17,689,012	12,728,652	17,664,733	1,642,359	1,794,525
Eastern Missouri, Iowa, Minnesota, and South Dakota	12	12	15,697,414	16,693,905	15,984,176	23,430,891	16,886,039	24,061,001	2,595,251	2,403,117
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	13	13	12,392,722	12,510,599	12,267,352	18,124,275	11,880,424	17,704,859	1,459,130	2,089,305
Texas	9	9	7,374,428	6,781,502	7,083,572	11,805,779	6,792,346	10,782,444	812,771	801,927
Colorado, Montana, Utah, Wyoming, and Idaho	9	9	2,695,024	2,268,813	2,766,167	5,764,757	2,375,335	4,657,623	459,822	353,300
California	12	12	13,091,899	10,124,219	12,964,746	22,805,576	10,438,479	15,241,089	1,077,385	763,125
Oregon and Washington	9	9	3,392,909	4,090,714	3,354,237	6,703,302	4,021,312	6,459,744	466,824	536,226
	163	163	170,646,036	161,197,228	169,868,322	252,153,789	159,059,334	228,779,756	23,700,533	25,838,427

[1] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Hydraulic cement imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Barrels	Value	Barrels	Value
1921	122, 317	$388, 842	1, 181, 014	$4, 276, 986
1922	355, 931	692, 429	1, 127, 845	3, 206, 201
1923	1, 767, 264	3, 145, 977	1, 001, 688	2, 944, 174
1924	2, 023, 663	3, 139, 788	878, 543	2, 615, 154
1925	3, 667, 458	5, 836, 482	1, 019, 597	3, 003, 128
1926	3, 244, 223	5, 154, 926	974, 326	2, 995, 833
1927	2, 065, 730	3, 007, 103	816, 726	2, 796, 717
1928	2, 302, 475	3, 135, 558	824, 656	2, 938, 702
1929	1, 745, 345	1, 983, 974	885, 321	3, 083, 217
1930	984, 807	1, 154, 562	755, 778	2, 454, 515

CHROMITE

Chromite shipped from mines in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	282	$2, 900	1926	141	$2, 079
1922	355	7, 288	1927	[1] 201	[1] 5, 063
1923	227	3, 819	1928	660	14, 807
1924	288	1, 140	1929	269	3, 976
1925	108	2, 105	1930	80	1, 905

[1] No shipments reported by producers to the Bureau of Mines for 1927. Division of Mines and Mining, Department of Natural Resources, California, reports 225 short tons, valued at $5,063 f. o. b. shipping point, as sold in 1927.

Crude chromite imported for consumption in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	81, 836	$654, 602	1926	215, 464	$1, 704, 947
1922	90, 081	741, 186	1927	222, 360	1, 748, 598
1923	129, 693	1, 123, 120	1928	216, 592	1, 704, 988
1924	118, 343	1, 095, 603	1929	317, 630	2, 666, 488
1925	149, 739	1, 207, 420	1930	326, 617	3, 513, 123

There are no exports of chromite.

CLAY

Clay sold by producers in the United States, 1921–1930

Year	Kaolin or china clay and paper clay		Ball clay		Slip clay		Fire clay	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	162, 726	$1, 579, 163	54, 014	$354, 565	4, 608	$14, 841	1, 195, 861	$3, 560, 373
1922	275, 675	2, 346, 095	76, 792	440, 877	4, 050	19, 405	1, 679, 220	4, 633, 486
1923	336, 803	2, 926, 255	97, 068	620, 978	8, 520	43, 609	2, 298, 163	6, 565, 899
1924	326, 611	2, 923, 965	83, 034	581, 966	5, 910	31, 023	2, 443, 710	6, 737, 063
1925	367, 319	3, 220, 719	109, 607	699, 427	7, 349	37, 397	2, 566, 934	7, 312, 349
1926	432, 215	3, 771, 568	112, 195	867, 500	8, 644	45, 959	2, 819, 346	8, 119, 323
1927	454, 245	3, 809, 834	119, 763	913, 976	6, 137	32, 264	2, 699, 761	7, 719, 725
1928	496, 142	4, 088, 003	120, 878	984, 075	5, 699	30, 796	2, 785, 158	7, 480, 609
1929	518, 169	4, 281, 301	118, 190	987, 306	6, 369	38, 582	3, 178, 805	8, 107, 586
1930	510, 354	3, 868, 922	93, 488	739, 787	4, 398	26, 465	2, 570, 608	6, 095, 555

Clay sold by producers in the United States, 1921–1930—Continued

Year	Stoneware clay		Bentonite [1]		Miscellaneous clay [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	86, 574	$184, 540	(1)	(1)	242, 963	$361, 818	1, 746, 746	$6, 055, 300
1922	86, 866	164, 870	(1)	(1)	525, 097	725, 781	2, 647, 700	8, 330, 514
1923	81, 389	194, 358	(1)	(1)	612, 717	837, 814	3, 434, 660	11, 188, 913
1924	59, 194	117, 142	(1)	(1)	772, 660	1, 116, 377	3, 691, 119	11, 507, 536
1925	77, 438	162, 161	(1)	(1)	901, 773	1, 304, 579	4, 030, 420	12, 736, 632
1926	84, 002	185, 288	(1)	(1)	510, 796	1, 115, 951	3, 967, 198	14, 105, 589
1927	98, 355	203, 648	(1)	(1)	470, 915	1, 017, 712	3, 849, 176	13, 697, 159
1928	95, 626	207, 275	(1)	(1)	522, 829	1, 409, 981	4, 026, 332	14, 200, 739
1929	87, 456	181, 901	(1)	(1)	438, 031	1, 254, 068	4, 347, 020	14, 850, 744
1930	75, 832	146, 513	107, 405	$858, 927	600, 818	785, 326	3, 962, 903	12, 521, 495

[1] Sales of bentonite included under "Miscellaneous clay" prior to 1930, when separate figures first became available.

Clay imported for consumption in the United States, 1921–1930 [1]

Year	Kaolin or china clay		Common blue and Gross Almerode glass-pot clay		All other clays [1]				Total [1]	
					Unwrought		Wrought			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	162, 906	$1, 546, 285	4, 468	$77, 217	41, 421	$348, 870	120	$2, 313	208, 915	$1, 974, 685
1922	310, 136	2, 963, 420	7, 323	84, 415	40, 624	327, 388	2, 566	29, 398	360, 649	3, 404, 621
1923	311, 298	3, 046, 191	12, 999	121, 272	65, 379	481, 614	1, 676	21, 892	391, 352	3, 670, 969
1924	353, 124	3, 188, 454	7, 059	62, 883	82, 562	706, 018	1, 322	18, 685	444, 067	3, 976, 040
1925	372, 552	3, 195, 694	11, 889	107, 940	49, 991	499, 325	2, 383	29, 266	436, 815	3, 832, 225
1926	396, 219	3, 484, 054	6, 608	60, 391	84, 512	672, 223	2, 331	31, 243	489, 670	4, 247, 911
1927	339, 014	2, 937, 113	3, 884	39, 451	50, 017	447, 888	1, 585	24, 518	394, 500	3, 448, 970
1928	307, 304	2, 962, 269	10, 259	90, 742	51, 163	429, 788	1, 653	23, 564	370, 379	3, 506, 363
1929	279, 981	2, 700, 296	28, 008	268, 011	49, 324	420, 689	12, 283	154, 158	369, 596	3, 543, 154
1930	236, 251	2, 197, 540	18, 900	154, 428	24, 883	209, 175	2, 321	43, 038	[1] 282, 355	[1] 2, 604, 181

[1] In addition 2,663 short tons of "clays or earths, artificially activated with acid or other material," valued at $100,779, imported from June 18 to Dec. 31, 1930; not separately recorded prior to change in tariff.

Domestic clay exported from the United States, 1921–1930

Year	Fire clay		All other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	23, 666	$177, 979	23, 779	$183, 449	47, 445	$361, 428
1922	24, 391	169, 664	[1] 23, 285	[1] 267, 908	47, 676	437, 572
1923	50, 055	303, 675	34, 840	329, 192	84, 895	632, 867
1924	41, 704	312, 676	31, 051	420, 040	72, 755	732, 716
1925	44, 037	350, 571	39, 006	530, 995	83, 043	881, 566
1926	47, 737	348, 302	42, 157	644, 416	89, 894	992, 718
1927	48, 106	392, 327	51, 278	725, 562	99, 384	1, 117, 889
1928	60, 138	494, 241	60, 911	896, 350	121, 049	1, 390, 591
1929	76, 561	588, 770	76, 789	1, 117, 312	153, 350	1, 706, 082
1930	62, 660	519, 788	73, 876	1, 108, 586	136, 530	1, 628, 374

[1] Includes 2,091 short tons of "kaolin, china, and paper clay," valued at $27,840. Similar exports not separately recorded for other years.

CLAY PRODUCTS

Value of clay products of the United States, 1921–1930 [1]

Year	Brick and tile	Pottery	Total	Year	Brick and tile	Pottery	Total
1921	$186, 589, 507	$84, 149, 029	$270, 738, 536	1926	$313, 935, 186	$116, 492, 308	$430, 428, 494
1922	[2] 229, 508, 106	91, 986, 297	[2] 321, 494, 403	1927	292, 322, 616	111, 612, 931	403, 935, 547
1923	309, 631, 561	114, 951, 067	424, 582, 628	1928	265, 770, 513	107, 780, 369	373, 550, 882
1924	297, 764, 393	118, 014, 985	415, 779, 378	1929	261, 390, 174	112, 019, 217	373, 409, 391
1925	311, 428, 417	112, 018, 500	423, 446, 917	1930	189, 553, 239	85, 581, 083	275, 134, 322

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Includes value of "prepared clay," figures for which are not separately published.

Clay products of the United States, 1929 and 1930, by products [1]

Product	1929		1930	
	Quantity	Value	Quantity	Value
Common brick...thousands	5, 505, 359	$58, 732, 635	3, 631, 436	$37, 432, 814
Face brick...do	2, 139, 408	36, 119, 826	1, 481, 825	24, 614, 992
Enameled brick...do	17, 137	1, 259, 248	13, 402	940, 774
Hollow brick...do	25, 803	345, 380	12, 063	134, 869
Terra cotta...short tons	133, 958	13, 921, 244	96, 396	10, 016, 166
Hollow building tile...do	3, 659, 811	21, 972, 958	2, 793, 853	16, 867, 085
Tile (other than hollow and drain)		32, 845, 835		23, 934, 451
Flue lining...short tons	243, 333	2, 499, 320	(2)	(2)
Conduit...do	503, 710	8, 169, 309	354, 152	5, 351, 797
Vitrified brick or block...thousands	367, 650	7, 503, 930	299, 865	6, 246, 967
Draintile...short tons	858, 521	6, 515, 718	675, 276	5, 011, 653
Sewer pipe...do	1, 675, 453	21, 330, 167	1, 270, 527	15, 963, 712
Stove lining...do	16, 805	468, 248	9, 386	329, 665
Fire brick:				
Standard...thousands	938, 218	36, 168, 898	738, 934	29, 737, 369
Special shapes...short tons	182, 280	4, 092, 295	191, 539	4, 724, 184
High-alumina...thousands	23, 911	2, 114, 925	11, 833	1, 592, 390
Glass-house tank blocks, melting pots, etc...short tons	35, 912	2, 276, 009	34, 417	1, 953, 644
Wall coping...do	41, 698	507, 080	33, 638	389, 936
Chimney pipe and tops...do	19, 885	310, 113	7, 295	160, 718
Segment blocks...do	50, 546	734, 272	46, 096	590, 588
Miscellaneous		3, 502, 764		3, 559, 465
Total brick and tile		261, 390, 174		189, 553, 239
Total pottery		112, 019, 217		85, 581, 083
Grand total		373, 409, 391		275, 134, 322

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."

Value of clay products of the United States, 1929 and 1930, by States [1]

State	1929				1930			
	Number of firms reporting	Brick and tile	Pottery	Total	Number of firms reporting	Brick and tile	Pottery	Total
Alabama	39	$3,969,005	$32,628	$4,001,633	40	$2,288,381	$6,953	$2,295,334
Arizona	9	506,215	------------	506,215	8	236,653	------------	236,653
Arkansas	12	1,961,215	63,188	2,024,403	10	1,074,103	------------	1,074,103
California	133	18,172,606	4,561,368	22,733,974	119	2,904,933	3,304,504	16,209,437
Colorado	37	2,789,678	327,386	3,117,064	40	2,131,347	354,337	2,485,684
Connecticut	22	2,038,539	(2)	[3] 2,038,539	20	(2)	(2)	1,547,524
Delaware	6	230,441	------------	230,441	7	157,391	------------	157,391
District of Columbia	4	194,908	(2)	[3] 194,908	4	(2)	(2)	298,441
Florida	7	281,741	(2)	[3] 281,741	11	(2)	(2)	137,543
Georgia	28	3,691,185	26,488	3,717,673	33	2,426,222	13,028	2,439,250
Idaho	6	151,320	------------	151,320	4	122,710	------------	122,710
Illinois	120	21,427,027	5,964,041	27,391,068	125	13,345,971	4,174,459	17,520,430
Indiana	84	14,595,987	3,907,253	18,503,240	92	9,526,595	2,506,257	12,032,852
Iowa	43	5,770,125	(2)	[3] 5,770,125	47	(2)	(2)	4,671,487
Kansas	24	3,279,953	(2)	[3] 3,279,953	26	(2)	(2)	2,315,005
Kentucky	42	6,934,741	127,479	7,062,220	38	(2)	(2)	5,563,392
Louisiana	17	583,513	(2)	[3] 583,513	16	(2)	(2)	375,750
Maine	16	641,364	------------	641,364	14	459,406	------------	459,406
Maryland	26	2,455,910	2,659,906	5,115,816	26	(2)	(2)	3,513,008
Massachusetts	32	2,126,937	445,014	2,571,951	33	1,474,406	244,384	1,718,790
Michigan	35	3,076,403	3,140,615	6,217,018	34	(2)	(2)	4,891,647
Minnesota	19	1,584,401	501,296	2,085,697	17	(2)	(2)	1,647,007
Mississippi	22	1,143,917	45,225	1,189,142	23	583,995	29,355	613,350
Missouri	49	14,933,916	60,632	14,994,548	49	(2)	(2)	12,517,707
Montana	9	353,219	------------	353,219	9	295,513	------------	295,513
Nebraska	16	914,304	(2)	[3] 914,304	16	(2)	(2)	496,714
Nevada	1	(2)	------------	(2)	1	(2)	------------	(2)
New Hampshire	12	900,388	------------	900,388	14	928,138	------------	928,138
New Jersey	120	19,112,238	20,305,730	39,417,968	116	14,642,080	14,456,246	29,098,326
New Mexico	5	155,138	------------	155,138	4	181,117	------------	181,117
New York	83	11,071,518	6,590,193	17,661,711	79	8,268,377	6,569,053	14,837,430
North Carolina	64	3,139,723	57,107	3,196,830	56	1,673,773	40,531	1,714,304
North Dakota	5	174,892	------------	174,892	5	160,838	------------	160,838
Ohio	329	46,372,475	35,425,020	81,797,495	335	36,107,758	25,341,797	61,449,555
Oklahoma	17	1,892,919	------------	1,892,919	21	(2)	(2)	941,365
Oregon	20	636,310	73,184	709,494	18	(2)	(2)	393,955
Pennsylvania	266	41,478,737	8,195,755	49,674,492	242	30,989,506	7,347,204	38,336,710
Rhode Island	1	(2)	------------	(2)	1	(2)	------------	(2)
South Carolina	24	1,231,106	21,711	1,252,817	21	785,982	6,779	792,761
South Dakota	1	(2)	------------	(2)	2	(2)	------------	(2)
Tennessee	32	2,732,166	963,671	3,695,837	25	(2)	(2)	1,915,224
Texas	59	5,800,531	209,648	6,010,179	48	3,876,251	131,607	4,007,858
Utah	9	1,028,342	(2)	[3] 1,028,342	11	(2)	(2)	732,608
Vermont	1	(2)	------------	(2)	1	(2)	------------	(2)
Virginia	45	2,948,309	(2)	[3] 2,948,309	40	(2)	(2)	2,380,100
Washington	29	2,520,836	46,055	2,566,891	29	2,364,542	36,240	2,400,782
West Virginia	45	4,782,551	15,707,704	20,490,255	39	3,374,996	12,579,199	15,954,195
Wisconsin	32	1,043,261	1,758,048	2,801,309	32	(2)	(2)	2,778,533
Wyoming	5	172,630	------------	172,630	6	177,445	------------	177,445
Undistributed	------	387,534	802,872	1,190,406	------	38,994,810	8,439,150	316,950
	2,062	261,390,174	112,019,217	373,409,391	2,007	189,553,239	85,581,083	275,134,322

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[1] Figures obtained through cooperation with Bureau of the Census.

[2] Included under "Undistributed."

[3] Exclusive of pottery, value for which is included under "Undistributed."

Value of clay products imported for consumption in the United States, 1921–1930

Year	Pottery								Brick, fire brick, tile, and miscellaneous clay products	Grand total
	Brown earthen and common stoneware[1]	Tobacco pipes and pipe bowls of clay	Earthenware and crockery composed of a nonvitrified absorbent body		China and porcelain		Sanitary earthenware, decorated and not decorated	Total		
			Not decorated	Decorated	Not decorated	Decorated				
1921	$288,893	$11,535	$405,370	$3,871,554	$646,427	$6,918,179	$12,067	$12,154,025	$228,804	$12,382,829
1922	341,997	15,638	339,066	4,427,001	641,261	6,298,440	17,295	12,080,698	375,764	12,456,462
1923	263,388	26,606	881,480	4,916,906	864,239	8,830,266	346,589	16,129,474	864,124	16,993,598
1924	314,721	14,517	765,070	5,041,570	799,772	9,504,905	125,100	16,565,655	690,639	17,256,294
1925	401,421	22,385	544,124	5,679,094	699,792	9,994,062	5,463	17,346,341	935,507	18,281,848
1926	379,951	21,661	445,436	6,444,433	623,360	11,383,666	1,873	19,280,380	1,939,843	21,220,223
1927	209,736	10,327	458,141	7,320,731	578,499	11,875,202	4,950	20,457,586	1,849,355	22,306,941
1928	155,539	11,575	389,332	6,085,149	476,275	9,338,946	6,626	16,463,442	1,955,629	18,419,071
1929	139,864	8,969	342,803	7,599,715	522,102	9,443,385	5,990	18,062,828	1,940,347	20,003,175
1930	93,758	5,650	166,136	6,243,954	478,770	7,649,549	39,444	14,677,261	791,204	15,468,465

[1] Including Rockingham ware and miscellaneous pottery products.

Value of clay products of domestic manufacture exported from the United States, 1921–1930

Year	Building brick and hollow tile[1]	Fire brick	Wall and floor tile[2]	Earthen and stoneware	China	Sanitary earthenware	Electric porcelain	All other	Total
1921	[1]$415,402	$2,314,911	[2]$814,456	$1,014,329	$312,161	$535,506	(3)	$873,182	$6,279,947
1922	210,215	1,581,679	390,408	981,082	316,973	561,536	$1,379,750	220,199	5,641,842
1923	282,454	2,332,536	373,866	932,779	334,146	657,859	1,783,614	132,228	6,829,482
1924	222,033	1,463,412	400,452	753,652	259,098	745,746	1,767,323	96,001	5,707,717
1925	194,153	1,323,128	396,088	758,883	255,578	788,528	949,785	91,699	4,757,842
1926	176,711	1,406,809	376,162	694,736	268,796	1,026,636	1,541,675	149,456	5,640,981
1927	161,346	3,024,156	391,190	862,396	338,955	1,198,660	1,201,481	108,857	7,287,041
1928	263,786	3,543,735	298,494	817,381	389,675	1,371,005	1,375,764	110,012	8,169,852
1929	552,687	4,633,121	529,706	1,025,835	392,582	1,799,378	1,818,455	284,744	11,036,508
1930	399,376	3,674,278	555,765	831,043	350,291	1,376,952	1,428,159	319,680	8,935,544

[1] Classification in 1921 read "Building brick."
[2] Classification in 1921 read "Tile (except drain)."
[3] Not separately recorded prior to 1922.

COAL

Coal produced in the United States, 1921–1930

Year	Pennsylvania anthracite		Bituminous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	90,473,451	$452,304,903	415,921,950	$1,199,983,600	506,395,401	$1,652,288,600
1922	54,683,022	273,700,125	422,268,099	1,274,820,000	476,951,121	1,548,520,000
1923	93,339,009	506,786,768	564,564,662	1,514,621,000	657,903,671	2,021,408,000
1924	87,926,862	477,230,852	483,686,538	1,062,626,000	571,613,400	1,539,857,000
1925	61,817,149	327,664,512	520,052,741	1,060,402,000	581,869,890	1,388,067,000
1926	84,437,452	474,164,252	573,366,985	1,183,412,000	657,804,437	1,657,576,000
1927	80,095,564	420,941,726	517,763,352	1,029,657,000	597,858,916	1,450,599,000
1928	75,348,069	393,637,690	500,744,970	933,774,000	576,093,039	1,327,412,000
1929	73,828,195	385,642,751	534,988,593	952,781,000	608,816,788	1,338,424,000
1930	69,384,837	354,574,191	467,526,299	795,483,000	536,911,136	1,150,057,000

Coal produced in the United States, 1929 and 1930, by States

[Exclusive of product of wagon mines]

State	1929		1930	
	Short tons	Value	Short tons	Value
Alabama	17, 943, 923	$37, 309, 000	15, 570, 058	$31, 616, 000
Alaska	100, 610	528, 000	120, 100	631, 000
Arizona	10, 132	44, 000	9, 084	29, 000
Arkansas	1, 695, 108	5, 624, 000	1, 533, 434	5, 153, 000
California, Idaho, Nevada,[1] and Oregon	10, 322	37, 000	18, 538	100, 000
Colorado	9, 920, 741	26, 254, 000	8, 196, 910	21, 485, 000
Georgia	44, 636	136, 000	7, 092	18, 000
Illinois	60, 657, 641	113, 453, 000	53, 731, 230	93, 484, 000
Indiana	18, 344, 358	29, 880, 000	16, 489, 962	26, 178, 000
Iowa	4, 241, 069	11, 948, 000	3, 892, 571	10, 385, 000
Kansas	2, 975, 971	6, 697, 000	2, 429, 929	5, 231, 000
Kentucky	60, 462, 600	93, 283, 000	51, 208, 995	76, 186, 000
Maryland	2, 649, 114	4, 640, 000	2, 270, 593	3, 690, 000
Michigan	804, 869	2, 904, 000	661, 113	2, 323, 000
Missouri	4, 030, 311	9, 778, 000	3, 853, 150	8, 967, 000
Montana	3, 407, 526	7, 561, 000	3, 022, 004	6, 043, 000
New Mexico	2, 622, 769	8, 314, 000	1, 969, 433	6, 017, 000
North Carolina	52, 180	177, 000	28, 500	100, 000
North Dakota	1, 862, 130	3, 157, 000	1, 700, 157	2, 768, 000
Ohio	23, 689, 477	35, 733, 000	22, 551, 978	31, 643, 000
Oklahoma	3, 774, 080	11, 481, 000	2, 793, 954	7, 768, 000
Pennsylvania, bituminous	143, 516, 241	258, 607, 000	124, 462, 787	213, 584, 000
South Dakota	12, 854	38, 000	12, 810	31, 000
Tennessee	5, 405, 464	9, 122, 000	5, 130, 428	8, 417, 000
Texas	1, 100, 668	1, 600, 000	833, 872	1, 307, 000
Utah	5, 160, 521	12, 725, 000	4, 257, 541	10, 515, 000
Virginia	12, 748, 306	20, 942, 000	10, 907, 377	17, 520, 000
Washington	2, 521, 327	8, 647, 000	2, 301, 928	7, 439, 000
West Virginia	138, 518, 855	215, 110, 000	121, 472, 638	181, 722, 000
Wyoming	6, 704, 790	17, 052, 000	6, 088, 133	15, 133, 000
Total bituminous	534, 988, 593	952, 781, 000	467, 526, 299	795, 483, 000
Pennsylvania anthracite	73, 828, 195	385, 642, 751	69, 384, 837	354, 574, 191
Grand total	608, 816, 788	1, 338, 424, 000	536, 911, 136	1, 150, 057, 000

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[1] No production reported from Nevada for 1930.

Coal produced in the United States, 1929 and 1930, by months, in short tons

Month	Pennsylvania anthracite		Bituminous	
	1929	1930	1929	1930
January	7, 068, 000	6, 996, 000	52, 398, 000	50, 414, 000
February	6, 425, 000	6, 120, 000	48, 137, 000	40, 060, 000
March	4, 859, 000	4, 524, 000	40, 068, 000	36, 230, 000
April	6, 205, 000	4, 887, 000	37, 565, 000	36, 318, 000
May	6, 077, 000	5, 911, 000	40, 908, 000	36, 413, 000
June	4, 883, 000	5, 152, 000	38, 771, 000	34, 145, 000
July	4, 810, 000	5, 624, 000	41, 379, 000	35, 158, 000
August	5, 735, 000	6, 153, 000	44, 695, 000	36, 117, 000
September	6, 543, 000	5, 261, 000	45, 334, 000	39, 126, 000
October	8, 026, 000	7, 531, 000	52, 174, 000	44, 714, 000
November	5, 820, 000	5, 176, 000	46, 514, 000	38, 609, 000
December	7, 377, 000	6, 050, 000	47, 046, 000	40, 222, 000
	73, 828, 000	69, 385, 000	534, 989, 000	467, 526, 000

Coal imported for consumption in the United States, 1921–1930

Year	Anthracite		Bituminous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	8,894	$93,103	1,257,589	$7,363,945	1,266,483	$7,457,048
1922	233,528	1,502,192	5,059,999	26,747,374	5,293,527	28,249,566
1923	300,360	2,114,080	1,881,465	10,128,516	2,181,825	12,242,596
1924	117,914	880,364	416,736	2,135,402	534,650	3,015,766
1925	382,894	3,212,505	601,737	2,633,980	984,631	5,846,485
1926	813,956	6,996,739	485,298	2,300,570	1,299,254	9,297,309
1927	119,030	837,033	548,278	2,435,212	667,308	3,272,245
1928	384,707	2,591,041	547,505	2,402,083	932,212	4,993,124
1929	487,172	3,328,838	495,218	2,157,364	982,390	5,486,202
1930	674,812	4,376,315	238,226	1,134,801	913,038	5,511,116

Coal exported from the United States, 1921–1930

Year	Anthracite		Bituminous (exclusive of bunker coal)		Total (exclusive of bunker coal)		Bunker coal	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	4,677,368	$45,624,555	23,131,166	$122,597,038	27,808,534	$168,221,593	8,453,220	$52,277,668
1922	2,649,457	25,350,677	12,413,085	65,891,740	15,062,542	91,242,417	4,614,632	27,912,957
1923	5,090,138	49,577,339	21,453,579	104,546,585	26,543,717	154,123,924	5,093,024	31,469,788
1924	4,017,785	40,067,804	17,100,347	70,971,302	21,118,132	111,039,106	4,460,412	22,883,293
1925	3,179,006	31,760,627	17,461,560	68,402,668	20,640,566	100,163,295	4,865,521	25,397,831
1926	4,029,683	41,085,946	35,271,937	155,818,572	39,301,620	196,904,518	7,735,606	38,025,411
1927	3,325,507	32,927,796	18,011,744	71,328,924	21,337,251	104,256,720	4,565,278	22,077,203
1928	3,336,272	32,656,523	16,164,485	59,464,348	19,500,757	92,120,871	4,294,223	20,558,057
1929	3,406,369	32,568,523	17,429,298	65,741,852	20,835,667	98,310,375	4,286,519	19,575,095
1930	2,551,659	24,508,700	15,877,407	59,185,741	18,429,066	83,694,441	3,496,680	15,696,909

COBALT

No cobalt ores are known to have been produced in the United States from 1922 to 1930. In 1921, 42,086 pounds of heterogenite (cobalt oxide), containing 4,018 pounds of cobalt, were mined near Goodsprings, Nev.; it was shipped in 1922 and sold for $1,419.

Cobalt ore, cobalt, and oxide imported for consumption in the United States, 1921–1930

Year	Ore		Cobalt		Oxide		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	7,657	$3,235	38,442	$105,539	164,003	$342,426	210,102	$451,200
1922	5,195	7,075	126,364	321,396	217,530	435,895	[1] 349,089	[1] 764,366
1923	58,719	56,326	225,639	552,434	258,574	511,903	[1] 542,932	[1] 1,120,663
1924	28,786	37,276	118,952	264,935	226,703	440,898	[1] 374,441	[1] 743,109
1925	34,782	31,320	198,669	422,185	287,265	546,292	[1] 520,716	[1] 999,797
1926	154,468	55,820	387,076	820,873	333,132	632,478	[1 2] 874,786	[1 2] 1,509,211
1927	60,382	3,019	407,198	841,442	369,747	703,608	[1] 837,327	[1] 1,548,069
1928	107,498	25,922	535,817	1,147,574	364,154	692,753	[1] 1,007,469	[1] 1,866,249
1929	434,443	51,862	806,640	1,743,465	475,928	884,873	[1] 1,717,011	[1] 2,680,200
1930	199,642	18,994	460,251	984,244	425,881	769,331	[1] 1,085,774	[1] 1,772,569

[1] Also 11 pounds of "other salts and compounds," valued at $26, imported Sept. 22 to Dec. 31, 1922. Not separately recorded prior to change in tariff. Similar additional imports in 1923 were 45,644 pounds, valued at $27,356; in 1924, 797 pounds, $856; in 1925, 13,256 pounds, $7,894; in 1926, 37,342 pounds, $21,647; in 1927, 55,127 pounds, $28,681; in 1928, 68,281 pounds, $39,993; in 1929, 64,782 pounds, $37,548; and in 1930, 55,303 pounds, $24,121.

[2] Includes 110 pounds of zaffer, valued at $40, in 1926. No zaffer imported 1921 to 1925 and 1927 to 1930.

COKE AND COKE-OVEN BY-PRODUCTS

COKE

Coke produced in the United States, 1921–1930

Year	Beehive		By-product		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	5,538,042	$30,166,449	19,749,580	$117,506,646	25,287,622	$147,673,095
1922	8,573,467	50,036,556	28,550,545	188,276,767	37,124,012	238,313,323
1923	19,379,870	115,905,580	37,597,664	257,591,318	56,977,534	373,496,898
1924	10,286,037	48,351,552	33,983,568	195,690,009	44,269,605	244,041,561
1925	11,354,784	51,731,566	39,912,159	210,827,571	51,266,943	262,559,137
1926	12,488,951	57,024,869	44,376,586	250,748,533	56,865,537	307,773,402
1927	7,207,417	30,276,775	43,884,726	232,043,803	51,092,143	262,320,578
1928	4,492,803	16,318,556	48,313,025	236,515,204	52,805,828	252,833,760
1929	6,472,019	22,564,424	53,411,826	256,430,168	59,883,845	278,994,592
1930	2,776,316	9,513,357	45,195,705	199,623,905	47,972,021	209,137,262

Coke produced in the United States, 1929 and 1930, by States and kinds

State	Beehive		By-product		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1929						
Alabama			4,753,967	$12,659,148	4,753,967	$12,659,148
Colorado	156,426	(1)	565,031	(1)	721,457	(1)
Connecticut			(2)	(2)	(2)	(2)
Illinois			4,204,116	26,036,197	4,204,116	26,036,197
Indiana			6.455,378	41,208,876	6.455,378	41,208,876
Kentucky			(2)	(2)	(2)	(2)
Maryland			1,393,052	(1)	1,393,052	(1)
Massachusetts			776,679	5,919,159	776,679	5,919,159
Michigan			2,679,971	14,867,651	2,679,971	14,867,651
Minnesota			746,004	6,478,228	746,004	6,478,228
Missouri			(2)	(2)	(2)	(2)
New Jersey			897,530	(1)	897,530	(1)
New York			4,299,470	25,305,915	4,299,470	25,305,915
Ohio	(3)	(3)	8,521,132	35,202,383	[4]8,521,132	[4]35,202,383
Pennsylvania	[3]5,367,685	[3]$17,824,426	14,489,283	55,088,803	[3]19,856,968	[3]72,913,229
Rhode Island			(2)	(2)	(2)	(2)
Tennessee	95,881	413,461	113,285	672,913	209,166	1,086,374
Utah	14,055	(1)	267,939	(1)	281,994	(1)
Virginia	314,859	1,283,740			314,859	1,283,740
Washington	25,844	207,674	40,879	286,153	66,723	493,827
West Virginia	497,269	1,675,544	1,431,314	3,610,883	1,928,583	5,286,427
Wisconsin			(2)	(2)	(2)	(2)
Combined States			1,776,796	12,668,372	1,776,796	12,668,372
Undistributed		1,159,579		16,425,487		17,585,066
	6,472,019	22,564,424	53,411,826	256,430,168	59,883,845	278,994,592
1930						
Alabama			3,986,920	10,741,937	3,986,920	10,741,937
Colorado	[5]79,373	(1)	379,070	(1)	458,443	(1)
Connecticut			(2)	(2)	(2)	(2)
Illinois			3,576,577	21,379,784	3,576,577	21,379,784
Indiana			4,984.620	12,166,488	4,984.620	12,166,488
Kentucky			(2)	(2)	(2)	(2)
Maryland			1,169,016	(1)	1,169,016	(1)
Massachusetts			862,663	6,697,235	862,663	6,697,235
Michigan			2,603,815	14,222,856	2,603,815	14,222,856
Minnesota			641,205	5,508,979	641,205	5,508,979
Missouri			(2)	(2)	(2)	(2)
New Jersey			918,814	(1)	918,814	(1)
New York			3,849,563	24,657,090	3,849,563	24,657,090
Ohio			6,163,324	26,706,788	6,163,324	26,706,788
Pennsylvania	2,011,324	6,407,168	12,529,255	47,691,068	14,540,579	54,098,236
Rhode Island			(2)	(2)	(2)	(2)
Tennessee	25,473	77,864	100,439	445,949	125,912	523,813
Utah	6,508	(1)	225,361	(1)	231,869	(1)
Virginia	219,656	846,542			219,656	846,542
Washington	12,252	98,516	36,221	256,807	48,473	355,323
West Virginia	421,730	1,474,442	1,479,431	3,587,317	1,901,161	5,061,759
Wisconsin			(2)	(2)	(2)	(2)
Combined States			1,689,411	11,584,309	1,689,411	11,584,309
Undistributed		608,825		13,977,298		14,586,123
	2,776,316	9,513,357	45,195,705	199,623,905	47,972,021	209,137,262

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[1] Included under "Undistributed."

[2] Included under "Combined States."

[3] The small output of beehive coke from Ohio included with Pennsylvania.

[4] Figures cover by-product coke only; beehive coke included with Pennsylvania.

[5] Quoted from Eighteenth Annual Report of the Colorado State Inspector of Coal Mines, 1930, p. 43.

Coke produced in the United States, 1929 and 1930, by months, in short tons

Month	1929			1930		
	Beehive	By-product	Total	Beehive	By-product	Total
January	515, 500	4, 355, 000	4, 870, 500	318, 000	4, 167, 100	4, 485, 100
February	473, 700	4, 084, 800	4, 558, 500	279, 000	3, 977, 200	4, 256, 200
March	574, 000	4, 607, 600	5, 181, 600	288, 700	4, 361, 400	4, 650, 100
April	503, 200	4, 451, 700	4, 954, 900	299, 600	4, 216, 800	4, 516, 400
May	642, 800	4, 658, 700	5, 301, 500	270, 100	4, 234, 800	4, 504, 900
June	648, 200	4, 504, 200	5, 152, 400	259, 800	3, 927, 500	4, 187, 300
July	645, 800	4, 608, 200	5, 254, 000	213, 100	3, 746, 700	3, 959, 800
August	604, 500	4, 637, 300	5, 241, 800	168, 300	3, 611, 100	3, 779, 400
September	542, 600	4, 407, 700	4, 950, 300	166, 900	3, 376, 100	3, 543, 000
October	505, 900	4, 604, 600	5, 110, 500	176, 600	3, 407, 800	3, 584, 400
November	444, 700	4, 316, 400	4, 761, 100	166, 300	3, 114, 000	3, 280, 300
December	371, 100	4, 175, 600	4, 546, 700	169, 900	3, 055, 200	3, 225, 100
	6, 472, 000	53, 411, 800	59, 883, 800	2, 776, 300	45, 195, 700	47, 972, 000

Coke imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1921	30, 990	$336, 394	306, 755	$2, 760, 939
1922	94, 228	802, 987	511, 541	4, 319, 538
1923	85, 002	862, 596	1, 237, 342	11, 889, 897
1924	82, 833	795, 477	659, 350	4, 926, 478
1925	201, 579	1, 609, 474	953, 812	6, 871, 962
1926	284, 548	2, 174, 350	987, 260	6, 979, 896
1927	168, 859	1, 371, 568	806, 664	5, 430, 704
1928	147, 701	1, 132, 855	1, 097, 666	7, 394, 531
1929	119, 724	1, 092, 235	1, 238, 035	7, 840, 368
1930	132, 674	1, 044, 020	1, 003, 866	6, 067, 318

COKE-OVEN BY-PRODUCTS

By-products from coke-oven operations in the United States, 1929 and 1930 [1]

[Exclusive of screenings and breeze]

Product	Produced	Sold	
		Quantity	Value
1929			
Tar gallons	680, 864, 366	333, 557, 501	$16, 982, 406
Ammonia:			
Sulphate pounds	1, 488, 314, 447	1, 433, 465, 592	25, 861, 479
Ammonia liquor (NH_3 content) do	56, 028, 347	55, 470, 678	2, 820, 802
Sulphate equivalent of all forms do	(1, 712, 427, 835)	(1, 655, 348, 304)	28, 682, 281
Gas:			
Distributed through city mains M cu. ft.	[2] 843, 148, 089	160, 560, 921	46, 994, 632
Used in steel or affiliated plants do		302, 165, 465	31, 901, 504
Used under boilers, etc do		18, 506, 502	1, 282, 327
Sold for industrial use do		26, 357, 691	4, 125, 807
			84, 304, 270

Footnotes at end of table.

By-products from coke-oven operations in the United States, 1929 and 1930—Con.

Product	Produced	Sold	
		Quantity	Value
1929—Continued			
Light oil and derivatives:			
Crude light oil gallons	[3] 200, 594, 027	11, 090, 709	$1, 374, 527
Benzol, crude and refined do	24, 944, 531	24, 558, 745	5, 169, 743
Motor benzol do	105, 923, 762	100, 807, 852	16, 063, 285
Toluol, crude and refined do	18, 343, 295	17, 064, 206	6, 580, 176
Solvent naphtha and xylol do	7, 131, 111	6, 581, 047	1, 591, 333
Other light-oil products do	6, 675, 386	1, 877, 176	124, 948
			30, 904, 012
Naphthalene, crude and refined pounds	19, 761, 382	19, 659, 367	320, 272
Creosote oil [4] gallons	24, 520, 839	23, 938, 431	2, 296, 862
Phenol (crude) do	84, 683	78, 869	28, 347
Pitch of tar short tons	88, 158	5, 599	27, 273
Other products [5]	----------	----------	129, 848
	----------	----------	163, 675, 571
1930			
Tar gallons	602, 485, 929	314, 865, 294	15, 562, 963
Ammonia:			
Sulphate pounds	1, 341, 919, 960	1, 310, 588, 322	20, 448, 633
Ammonia liquor (NH_3 content) do	49, 031, 133	45, 368, 290	2, 236, 063
Sulphate equivalent of all forms do	(1, 538, 044, 492)	(1, 492, 061, 482)	22, 684, 696
Gas:			
Distributed through city mains M cu. ft	[2] 724, 103, 004	164, 689, 727	48, 938, 752
Used in steel or affiliated plants do		231, 232, 552	24, 903, 906
Used under boilers, etc do		20, 408, 659	1, 185, 415
Sold for industrial use do		25, 787, 390	4, 266, 064
			79, 294, 137
Light oil and derivatives:			
Crude light oil gallons	[3] 178, 325, 952	9, 941, 904	983, 540
Benzol, crude and refined do	19, 142, 910	19, 187, 627	3, 377, 026
Motor benzol do	101, 862, 692	102, 572, 989	14, 427, 422
Toluol, crude and refined do	11, 833, 202	12, 083, 423	3, 613, 778
Solvent naphtha do	4, 078, 274	3, 647, 773	651, 146
Xylol do	2, 040, 024	1, 891, 764	481, 863
Other light-oil products do	6, 475, 725	1, 983, 034	120, 115
			23, 654, 890
Naphthalene, crude and refined pounds	12, 640, 102	13, 028, 904	161, 264
Tar derivatives:			
Creosote oil [4] gallons	25, 679, 882	28, 570, 764	2, 500, 076
Phenol (crude) do	136, 971	104, 546	38, 241
Pitch of tar short tons	106, 334	7, 465	46, 914
Other tar derivatives	----------	----------	55, 376
Other products [5]	----------	----------	95, 164
	----------	----------	144, 093, 721

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[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name, except phenol and other tar acids produced at Clairton, Pa., which are covered by report of United States Tariff Commission.

[2] Inclusive of gas wasted and gas used for heating retorts.

[3] Of the crude light oil 194,882,679 gallons in 1929 and 173,328,254 gallons in 1930 was refined on the premises to make the derived products listed.

[4] Includes creosote oil distilled as such and distillate in coal-tar solution.

[5] Carbolate, crude products, cyanogen, extil covering, smoke compound, sodium prussiate, sulphur, and tar paint.

COLUMBITE

[See Tantalum]

COPPER [1]

Summary of statistics of the copper industry in the United States, 1928–1930

	1928	1929	1930
Production of copper:			
Smelter output from domestic ores ....pounds..	1,825,900,393	2,002,863,135	1,394,389,327
Mine production ....do....	1,809,796,507	1,995,110,398	1,410,147,374
Refinery production of new copper—			
Electrolytic ....do....	1,607,120,026	1,785,754,654	1,228,416,733
Lake ....do....	179,104,311	185,300,917	142,985,522
Casting ....do....	5,573,050	11,676,718	19,821,950
Total domestic ....do....	1,791,797,387	1,982,732,289	1,391,224,205
Total domestic and foreign ....do....	2,487,607,779	2,740,112,376	2,157,059,178
Total new and old copper ....do....	3,560,000,000	3,996,000,000	3,091,000,000
Ore, old tailings, etc., produced:			
Copper ore, old tailings, etc ....short tons..	[2] 62,097,132	68,421,853	47,381,509
Average yield of copper ....per cent..	1.41	1.41	1.43
Copper-lead and copper-lead-zinc ores..short tons..	351,131	259,126	246,430
Average price per pound ....cents..	14.4	17.6	13.0
General imports (unmanufactured) ....pounds..	787,073,640	974,312,201	817,154,236
Exports of metallic copper [3] ....do....	1,121,186,640	992,895,119	753,114,927
Withdrawn from total supply on domestic account:			
Total new copper ....pounds..	1,608,538,878	1,778,585,415	1,265,016,702
Total new and old copper ....do....	2,681,000,000	3,032,000,000	2,199,000,000
Stocks at end of year:			
Refined copper ....do....	114,000,000	306,000,000	615,000,000
Blister and material in solution ....do....	423,000,000	500,000,000	450,000,000
World production (smelter) ....do....	3,761,085,000	4,199,805,000	3,467,870,000
Value of smelter production from domestic ores	$262,930,000	$352,504,000	$181,271,000

[1] For prices of copper, see statement on p. A14.

[2] Figures for 1928 cover ore only.

[3] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper for which figures are not separable from those for ore and concentrates; also exclusive of "Other manufactures of copper" for which figures for quantity are not recorded.

Copper produced in the United States from domestic ores, 1921–1930

[Smelter output, in pounds fine]

Year	Pounds	Value	Year	Pounds	Value
1921	505,586,098	$65,221,000	1926	1,739,622,094	$213,547,000
1922	950,285,947	128,289,000	1927	1,684,040,983	220,609,000
1923	1,434,999,962	210,945,000	1928	1,825,900,393	262,930,000
1924	1,634,249,192	214,087,000	1929	2,002,863,135	352,504,000
1925	1,674,869,886	237,832,000	1930	1,394,389,327	181,271,000

Copper produced in the United States from domestic ores, 1926–1930, by States

[Smelter output, in pounds fine]

State	1926	1927	1928	1929	1930
Alaska	67,631,846	56,489,214	40,541,968	39,867,940	36,380,038
Arizona	729,324,537	681,168,117	735,632,406	829,206,475	570,897,080
California	30,412,961	25,802,603	24,707,992	33,084,232	26,262,447
Colorado	4,657,591	8,006,801	10,262,083	10,519,784	12,943,857
Idaho	1,171,262	1,811,103	2,330,654	6,267,487	2,713,681
Michigan	174,778,884	195,155,199	179,104,311	185,300,917	142,985,522
Missouri	54,378	5,041	930	1,880	2,198
Montana	257,271,936	225,208,873	251,046,415	299,894,853	198,795,883
Nevada	109,041,769	118,298,342	159,332,977	138,990,247	87,475,019
New Mexico	82,848,096	79,761,222	92,777,233	100,165,206	74,187,966
North Carolina	1,468,746	5,362,041	8,207,000	(1)	(1)
Oregon	279,223	484,652	375,049	739,151	229,753
Pennsylvania	495,698	2,149,182	5,013,868	3,581,393	3,061,174
Tennessee	18,601,586	14,498,951	16,374,261	(1)	(1)
Texas	17,102	25,400	432,968	393,740	165,731
Utah	259,649,158	267,705,597	298,375,465	325,965,289	205,769,698
Vermont	446,323	238,143	....	752,200	(1)
Washington	1,336,617	1,766,953	1,197,340	1,569,260	1,404,893
Wyoming	....	....	2,575	4,305	29,356
Undistributed	104,381	123,509	178,898	26,558,776	31,085,031
	1,739,622,094	1,684,040,983	1,825,900,393	2,002,863,135	1,394,389,327

[1] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1926–1930, in pounds

	1926	1927	1928	1929	1930
Primary:					
Domestic [1]—					
Electrolytic	1,553,041,424	1,520,076,181	1,607,120,026	1,785,754,654	1,228,416,733
Lake	172,372,304	195,135,199	179,104,311	185,300,917	142,985,522
Casting	5,883,433	3,740,819	5,573,050	11,676,718	19,821,950
	1,731,297,161	1,718,952,199	1,791,797,387	1,982,732,289	1,391,224,205
Foreign [1]—					
Electrolytic	588,932,788	605,748,329	693,787,036	756,555,087	765,189,037
Casting and best select	2,255,427	1,063,181	2,023,356	825,000	645,936
Total refinery production of new copper	2,322,485,376	2,325,763,709	2,487,607,779	2,740,112,376	2,157,059,178
Imports of refined copper	170,565,766	103,279,082	84,730,630	134,014,792	86,210,331
Total new refined copper made available	2,493,051,142	2,429,042,791	2,572,338,409	2,874,127,168	2,243,269,509
Secondary:					
Electrolytic	163,061,465	168,766,566	191,323,029	331,858,103	279,423,370
Casting	62,056,941	41,102,000	41,322,776	2,300,000	1,106,114
	225,118,406	209,868,566	232,645,805	334,158,103	280,529,484
	2,718,169,548	2,638,911,357	2,804,984,214	3,208,285,271	2,523,798,993

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[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

In addition to their output of metallic copper, the regular refining companies produced bluestone having copper content as follows: 1926, 8,498,000 pounds; 1927, 9,180,000 pounds; 1928, 11,326,000 pounds; 1929, 10,255,000 pounds; 1930, 9,419,000 pounds.

Stocks of copper in the United States, January 1, 1922–1931, in pounds

Year	Refined copper	Blister and material in process of refining	Year	Refined copper	Blister and material in process of refining
1922	459,000,000	283,000,000	1927	146,000,000	455,000,000
1923	216,000,000	361,000,000	1928	171,000,000	401,000,000
1924	264,000,000	432,000,000	1929	114,000,000	423,000,000
1925	243,000,000	393,000,000	1930	306,000,000	500,000,000
1926	124,000,000	432,000,000	1931	615,000,000	450,000,000

New refined copper withdrawn from total year's supply on domestic account in the United States, 1926–1930, in pounds

	1926	1927	1928	1929	1930
Total supply of new copper	2,493,051,142	2,429,042,791	2,572,338,409	2,874,127,168	2,243,269,509
Stocks at beginning of year	124,000,000	146,000,000	171,000,000	114,000,000	306,000,000
Total available supply	2,617,051,142	2,575,042,791	2,743,338,409	2,988,127,168	2,549,269,509
Copper exported	900,914,935	981,083,572	1,020,799,531	903,541,753	669,252,807
Stocks at end of year	146,000,000	171,000,000	114,000,000	306,000,000	615,000,000
	1,046,914,935	1,152,083,572	1,134,799,531	1,209,541,753	1,284,252,807
Withdrawn on domestic account	1,570,136,207	1,422,959,219	1,608,538,878	1,778,585,415	1,265,016,702

Copper (in unmanufactured form) imported for consumption in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	350, 582, 746	$45, 660, 326	1926	779, 437, 231	$99, 679, 746
1922	542, 932, 525	65, 786, 811	1927	718, 322, 990	84, 769, 961
1923	671, 929, 223	92, 398, 681	1928	787, 081, 065	97, 965, 353
1924	765, 685, 692	95, 608, 460	1929	974, 076, 610	153, 414, 829
1925	654, 065, 759	83, 948, 686	1930	817, 154, 684	104, 377, 768

Copper (unmanufactured) imported into the United States, 1929 and 1930, in pounds [1]

[General imports]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper fit only for remanufacture, and scale and clippings	Composition metal, copper chief value
1929							
Africa:							
Belgian Congo	263, 720			55, 091, 068			
British (Union of South)	30, 805	179, 999					
Portuguese (Mozambique)	931	2, 900	52, 924	7, 803, 865			
Australia	186, 762						
Canada	54, 844, 182	5, 833, 620	217, 780	132, 519, 194	679, 315	11, 394, 168	5, 002
Chile	40, 534, 646	1, 071, 394		164, 265, 111	133, 082, 539	14, 812	
Cuba	339, 713	9, 810, 270				1, 091, 152	
France	1, 185, 755	1, 111, 870		3, 717, 719	20, 616	49, 625	
Germany	1, 653, 882	1, 418, 540	105, 665	7, 114, 367	232, 322	151, 644	74, 214
Mexico	1, 447, 954	29, 909, 338	890, 490	138, 174, 222		148, 426	
Peru	7, 005, 284	50, 594	74, 096	117, 772, 651		27, 509	
Spain	14, 633, 315			2, 246, 767			
United Kingdom	1, 019, 777	9, 903		14, 435, 473		10, 280	560
Venezuela						91, 696	
Other	1, 472, 286	4, 330, 397	763, 500	3, 026, 618		618, 854	120
	124, 619, 012	53, 728, 825	2, 104, 455	646, 167, 055	134, 014, 792	13, 598, 166	79, 896
Total value	$15, 358, 271	$7, 907, 180	$292, 316	$104, 306, 141	$23, 757, 421	$1, 823, 464	$12, 064
1930							
Africa:							
Belgian Congo	397, 090			72, 061, 317			
Other Africa	36, 299	309, 820		14, 980			
Australia	80, 246	503, 834	64, 426	3, 466, 138			
Canada	48, 796, 081	7, 473, 652	10, 500	149, 323, 370	6, 266, 188	5, 793, 587	7, 653
Chile	29, 526, 290	58, 413	270, 332	78, 836, 782	79, 944, 143		
Cuba	5, 953, 778	20, 056, 670				633, 380	
France	968, 372	368, 248	212, 607	1, 747, 129		50, 237	
Germany	1, 104, 915	624, 009	1, 390, 288	5, 067, 395		232, 348	22, 160
Japan				14, 476, 145		195	
Mexico	1, 524, 758	24, 691, 583	645, 483	118, 381, 569		79, 140	
Peru	1, 109, 793	330, 907	33, 442	110, 679, 197			
Spain	9, 681, 185	41, 751	1, 624, 763	410, 262			
United Kingdom	77, 638	103, 632	327, 441	3, 270, 039		21, 106	672
Venezuela						73, 736	
Other	2, 060, 110	2, 308, 370	127, 100	2, 734, 824		615, 271	51, 447
	101, 316, 555	56, 870, 889	4, 706, 382	560, 469, 147	86, 210, 331	7, 499, 000	81, 932
Total value	$11, 395, 290	$5, 980, 059	$536, 429	$74, 247, 901	$11, 374, 184	$835, 838	$7, 929

[1] "Copper manufactures, n. e. s.," imported as follows: 1929, $253,323; 1930, $238,717; quantity not recorded.

Copper exported from the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	628, 804, 750	$85, 351, 928	1926 [1]	965, 685, 264	$139, 853, 365
1922	743, 039, 888	103, 874, 007	1927 [1]	1, 076, 729, 246	149, 114, 730
1923	829, 314, 002	129, 219, 975	1928 [1]	1, 125, 019, 417	168, 525, 383
1924	1, 116, 915, 484	156, 645, 684	1929 [1]	998, 474, 549	181, 684, 409
1925	1, 084, 208, 532	161, 165, 820	1930 [1]	753, 294, 022	104, 316, 175

[1] Exclusive of "Other manufactures of copper," valued at $1,350,391 in 1926, at $1,098,886 in 1927, at $1,296,996 in 1928, at $1,720,363 in 1929, and at $1,025,875 in 1930, for which quantity is not recorded.

Copper exported from the United States, 1929 and 1930, in pounds

Country	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
1929									
Belgium		45, 749, 962	2, 533, 960	614, 347			1, 360	35, 455	(1)
Canada	597, 049	38, 691, 880	22, 171, 079	4, 462, 840	2, 569, 479	3, 107, 052	1, 739, 064	3, 042, 952	
China		5, 604, 022		54, 480	5, 613	18, 006	596, 815	384, 296	
Denmark		1, 776, 102	336, 208			3, 528	18, 543	33, 839	
France		175, 264, 821	2, 500, 331	2, 654, 547	617		48, 686	132, 179	
Germany	375, 550	178, 879, 194	72, 372	19, 189, 236	243	672, 451	609, 875	12, 338	
India (British)		4, 043, 059	90, 513	157, 290	31, 569	14, 281	353, 961	450, 979	
Italy		84, 491, 310	313, 944	279, 512		651, 664	681, 485	1, 231, 826	
Japan		7, 953, 500	46, 601	4, 128, 957	3, 032	3, 475	186, 561	178, 484	
Netherlands	33, 997	32, 534, 775	5, 436, 278	2, 960, 086	6, 881	112, 497	60, 901	103, 191	
Norway		1, 366, 156	2, 573, 618	26, 400	5, 351		16, 038	21, 846	
Spain		2, 252, 963		1, 073, 444	5, 731		60, 029	53, 148	
Sweden		32, 495, 033	504, 674	12, 503			225, 500	8, 308	
Switzerland		336, 398					1, 382	4, 358	
United Kingdom	4, 536, 574	175, 449, 512	31, 713, 323	1, 958, 092	12, 888	870, 509	1, 049, 690	1, 499, 122	
Other	36, 260	35, 565, 237	12, 794, 928	63, 755	804, 670	869, 256	11, 218, 746	17, 888, 127	
Total value	5. 579, 430 $935, 604	822. 453, 924 $148, 435, 789	81, 087, 829 $14, 584, 737	37, 635, 489 $5, 675, 750	3, 446, 074 $967, 462	6, 322, 719 $1, 576, 383	16, 868, 636 $3, 332, 229	25, 080, 448 $6, 176, 455	(1) $1, 720, 363
1930									
Belgium		26, 364, 532	8, 106, 815	1, 075, 238		67, 211	251	90, 049	(1)
Canada	112, 377	13, 764. 603	21, 625, 069	1, 341, 203	1, 824, 655	2, 761, 757	464, 432	2, 263, 230	
China		5, 626, 532	4, 242	26, 660	94	8, 675	187, 620	276, 672	
Denmark		2, 099, 582	1, 008, 211		388	644	33, 432	19, 157	
France		141, 237, 293	1, 951, 292	4, 578, 216	1, 276	200. 336	44, 333	141, 445	
Germany		93, 860. 008		14, 288, 455	4, 561	829, 582	739, 712	4, 779	
India (British)		2, 680, 595	939, 375	576, 410	59	3, 019, 956	559, 302	180, 332	
Italy		78, 707, 287		106, 127		1, 827, 332	36, 228	23, 048	
Japan	1, 132	3, 187, 112	27, 314	1, 756, 257	1, 210	6, 384	15, 434	116, 977	
Netherlands	1, 976	27, 146, 308	5, 928, 285	5, 648, 314		583, 679	204, 269	42, 203	
Norway		1, 729, 632	2, 834, 119				3, 378	17, 054	
Russia in Europe		12, 695, 138					1, 963, 393	49, 226	
Spain		258, 487		2, 167, 672	13, 985		68, 072	154, 237	
Sweden		30, 673, 059				55, 920	15, 430	452, 115	
United Kingdom		142, 789, 077	27, 460, 545	2, 219, 607	7, 909	1, 027, 423	924, 449	1, 136, 061	
Other	63, 610	11, 295, 748	5, 252, 547	101, 481	843. 260	594, 470	10, 490, 690	15, 578. 704	
Total value	179, 095 $18, 569	594, 114, 993 $79, 691, 216	75, 137, 814 $10, 958, 235	33, 885, 640 $3, 744, 311	2, 697, 397 $673, 667	10, 983, 369 $1, 876, 248	15, 750, 425 $2, 714, 352	20, 545, 289 $4, 639, 577	(1) $1, 025, 875

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[1] Figures for quantity not recorded.

CORUNDUM

[See Abrasive materials]

CRYOLITE

No natural cryolite is produced in the United States, the entire supply in this country being imported from Greenland.

Cryolite imported for consumption in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	3, 460	$295, 186	1926	7, 599	$557, 598
1922	3, 899	196, 302	1927	5, 064	410, 876
1923	6, 375	319, 959	1928	6, 906	529, 176
1924	6, 320	320, 670	1929	7, 778	670, 841
1925	9, 844	690, 651	1930	8, 315	695, 794

DIATOMITE (INFUSORIAL EARTH)

[See Abrasive materials]

EMERY

[See Abrasive materials]

FELDSPAR

Crude feldspar sold or used by producers in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	91, 865	$617, 652	1926	209, 989	$1, 607, 101
1922	117, 127	844, 568	1927	202, 497	1, 424, 755
1923	145, 004	1, 057, 595	1928	210, 811	1, 418, 975
1924	204, 772	1, 509, 339	1929	197, 699	1, 276, 640
1925	185, 706	1, 315, 654	1930	171, 788	1, 066, 636

Feldspar imported for consumption in the United States, 1922–1930 [1]

Year	Crude		Crushed or ground	
	Long tons	Value	Long tons	Value
1922 (Sept. 22 to Dec. 31)	7, 549	$60, 111	37	$538
1923	24, 271	184, 924		
1924	35, 139	284, 716		
1925	24, 994	203, 524		
1926	29, 941	251, 896	36	1, 743
1927	27, 424	206, 856	(2)	3
1928	27, 857	224, 920	49	1, 091
1929	29, 927	241, 852	3	131
1930	21, 006	167, 157	51	586

[1] Imports not separately recorded prior to change in tariff, Sept. 22, 1922.
[2] 250 pounds.

There is no record of exports of feldspar, and if any feldspar is exported the quantity is doubtless negligible.

FERRO-ALLOYS

Ferro-alloys shipped from furnaces in the United States, 1921–1930, in long tons

Year	Ferromanganese	Spiegeleisen	Other varieties	Total	
				Quantity	Value
1921	111, 374	69, 230	68, 023	248, 627	$21, 697, 785
1922	161, 612	70, 253	191, 415	423, 280	28, 259, 004
1923	226, 365	134, 086	219, 366	579, 817	49, 877, 231
1924	232, 821	76, 179	188, 244	497, 244	43, 249, 948
1925	254, 005	95, 890	266, 327	616, 222	53, 048, 100
1926	330, 070	82, 982	276, 206	689, 258	61, 368, 407
1927	291, 056	80, 892	274, 801	646, 749	55, 163, 574
1928	310, 122	116, 911	367, 662	794, 695	66, 578, 039
1929	334, 162	123, 146	372, 016	829, 324	75, 506, 078
1930	273, 640	94, 918	281, 682	650, 240	51, 900, 220

Ferro-alloys shipped from furnaces in the United States, 1929 and 1930

Variety of alloy	1929		1930	
	Long tons	Value	Long tons	Value
Ferromanganese	334, 162	$33, 184, 012	273, 640	$25, 865, 783
Spiegeleisen	123, 146	3, 336, 703	94, 918	2, 469, 861
Ferrosilicon (7 per cen tor more silicon)	310, 280	15, 730, 950	234, 328	10, 430, 720
Ferrotungsten	3, 049	5, 828, 760	736	1, 603, 903
Ferrovanadium	1, 767	4, 665, 720	831	2, 244, 304
Other varieties [1]	56, 920	12, 759, 933	45, 787	9, 285, 649
	829, 324	75, 506, 078	650, 240	51, 900, 220

[1] Ferrochromium, ferromolybdenum and calcium-molybdenum compounds, ferrophosphorus, ferrotitanium, ferrozirconium, silicomanganese, silicospiegeleisen, and zirconium-ferrosilicon.

Value of ferro-alloys imported for consumption in the United States, 1921–1930

1921	$1, 576, 131	1926	$6, 303, 757
1922	7, 789, 632	1927	4, 752, 552
1923	9, 879, 433	1928	6, 158, 449
1924	5, 509, 020	1929	8, 609, 080
1925	7, 133, 618	1930	5, 866, 245

Ferro-alloys imported for consumption in the United States, 1929 and 1930

Variety of alloy	1929		1930	
	Long tons	Value	Long tons	Value
Ferromanganese (manganese content)	56, 969	$6, 126, 056	45, 001	$4, 128, 065
Spiegeleisen	13, 828	403, 853	13, 406	381, 197
Ferrochrome and chromium:				
Ferrochrome—				
Containing 3 per cent or more carbon (chromium content)	37	8, 835	----------	----------
Containing less than 3 per cent carbon	638	206, 311	153	31, 428
Chrome or chromium metal	21	5, 242	----------	----------
Ferrosilicon (silicon content)	9, 285	1, 388, 423	4, 541	623, 307
Molybdenum and ferromolybdenum (molybdenum content)	1	2, 384	65	283, 846
Titanium and ferrotitanium	7	2, 517	1	496
Tungsten and ferrotungsten (tungsten content)	211	376, 230	135	417, 906
Ferrovanadium	46	89, 229	----------	----------
	----------	8, 609, 080	----------	5, 866, 245

Ferro-alloys exported from the United States, 1921–1930

Variety of alloy	1921		1922		1923		1924		1925	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Ferromanganese	690	$100, 474	1, 107	$76, 822	4, 295	$151, 224	3, 165	$92, 421	5, 496	$160, 568
Spiegeleisen	(1)	(1)	289	7, 740						
Ferrochrome and chrome metal	(1)	(1)	23	1, 941	(2)	(2)	(2)	(2)	(2)	(2)
Ferrosilicon	368	20, 204	689	30, 939	814	31, 154	775	29, 214	(2)	(2)
Tungsten and ferrotungsten	----	----	(3)	43, 219	[4] 2	[4] 122, 906	[4] 2	[4] 114, 775	[4] 6	[4] 143, 987
Ferrovanadium	98	421, 886	22	69, 279	23	64, 713	25	81, 016	46	106, 754

Variety of alloy	1926		1927		1928		1929		1930	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Ferromanganese	693	$44, 111	1, 641	$61, 793	9, 440	$232, 990	1, 574	$59, 036	6, 189	$145, 629
Spiegeleisen										
Ferrochrome and chrome metal	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Ferrosilicon	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Tungsten and ferrotungsten (including tungsten wire)	13	155, 653	9	164, 917	7	123, 354	46	325, 133	13	221, 934
Ferrovanadium	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

[1] Not separately recorded prior to 1922.
[2] Not separately recorded.
[3] 1,000 pounds.
[4] Includes tungsten wire.

FLUORSPAR

Fluorspar shipped from mines in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	34, 960	$724, 094	1926	128, 657	$2, 341, 277
1922	141, 596	2, 531, 165	1927	112, 546	2, 034, 728
1923	121, 188	2, 505, 819	1928	140, 490	2, 656, 554
1924	124, 979	2, 451, 131	1929	146, 439	2, 791, 126
1925	113, 669	2, 052, 342	1930	95, 849	1, 746, 643

Fluorspar shipped from mines in the United States, 1929 and 1930, by States

State	1929		1930	
	Short tons	Value	Short tons	Value
Illinois	67, 009	$1, 284, 834	44, 134	$836, 473
Kentucky	70, 827	1, 390, 603	39, 181	763, 370
Colorado	4, 808	56, 607	9, 248	101, 758
New Mexico	2, 438	59, 082	2, 312	45, 042
Nevada	1, 357		974	
	146, 439	2, 791, 126	95, 849	1, 746, 643

Fluorspar imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	6, 229	$69, 306	1926	75, 626	$746, 479
1922	33, 108	299, 188	1927	71, 242	594, 082
1923	41, 884	429, 696	1928	47, 450	409, 841
1924	50, 821	551, 842	1929	54, 345	480, 999
1925	48, 770	469, 540	1930	64, 731	542, 249

No exports of fluorspar have been reported by Bureau of Foreign and Domestic Commerce. Producers have reported exports, as follows:

Fluorspar reported by producers as exported from the United States, 1921–1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1922	2, 296	$40, 966	1927	385	$7, 507
1923	1, 144	25, 312	1928	398	6, 586
1924	617	14, 489	1929	506	11, 621
1925	1, 055	17, 574	1930	281	6, 160
1926	2, 132	34, 915			

[1] No fluorspar reported by producers as exported in 1921.

FULLER'S EARTH

Fuller's earth sold or used by producers in the United States, 1921–1930

Year	Number of operators	Short tons	Value	Year	Number of operators	Short tons	Value
1921	12	105, 609	$1, 973, 848	1926	14	234, 152	$3, 356, 482
1922	15	138, 944	2, 289, 719	1927	16	264, 478	3, 767, 038
1923	15	149, 134	2, 247, 523	1928	17	287, 012	3, 895, 991
1924	13	177, 994	2, 632, 342	1929	17	315, 983	4, 309, 723
1925	14	206, 574	2, 923, 965	1930	15	335, 644	4, 326, 705

Fuller's earth imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	9, 744	$119, 415	1926	9, 098	$123, 674
1922	10, 569	135, 695	1927	7, 580	109, 281
1923	8, 547	113, 944	1928	7, 593	132, 003
1924	7, 302	92, 488	1929	8, 302	152, 432
1925	8, 015	111, 295	1930	7, 258	156, 520

Exports of fuller's earth are not separately recorded.

GARNET (ABRASIVE)

[See Abrasive materials]

GAS (NATURAL)

Natural gas produced in the United States and delivered to consumers, 1921–1930

[Value at point of consumption]

Year	M cubic feet	Value	Year	M cubic feet	Value
1921	662, 052, 000	$174, 617, 000	1926	1, 313, 019, 000	$300, 168, 000
1922	762, 546, 000	221, 535, 000	1927	1, 445, 428, 000	317, 930, 000
1923	1, 006, 976, 000	240, 001, 000	1928	1, 568, 139, 000	363, 726, 000
1924	1, 141, 521, 000	253, 856, 000	1929	1, 917, 693, 000	413, 276, 000
1925	1, 188, 571, 000	265, 271, 000	1930	1, 943, 421, 000	416, 090, 000

Natural gas produced in the United States and delivered to consumers, 1929 and 1930, by States

[Value at point of consumption]

State	1929		1930	
	M cubic feet	Value	M cubic feet	Value
Arkansas	19, 928, 000	$4, 802, 000	18, 585, 000	$3, 540, 000
California	342, 214, 000	68, 972, 000	334, 789, 000	69, 071, 000
Colorado	2, 787, 000	676, 000	3, 412, 000	958, 000
Illinois	2, 983, 000	388, 000	2, 890, 000	505, 000
Indiana	1, 012, 000	518, 000	1, 217, 000	676, 000
Kansas	38, 469, 000	13, 429, 000	37, 630, 000	12, 439, 000
Kentucky	27, 588, 000	8, 822, 000	28, 921, 000	9, 091, 000
Louisiana	261, 158, 000	20, 605, 000	278, 341, 000	35, 895, 000
Michigan	4, 526, 000	960, 400	2, 075, 000	626, 000
Mississippi	90, 000	32, 000	179, 000	89, 000
Missouri	324, 000	104, 000	1, 064, 000	326, 000
Montana	9, 659, 000	2, 377, 000	10, 090, 000	2, 930, 000
New Mexico	3, 054, 000	536, 000	9, 497, 000	1, 273, 000
New York	8, 387, 000	5, 538, 000	9, 621, 000	6, 453, 000
Ohio	57, 935, 000	32, 880, 000	63, 394, 000	36, 491, 000
Oklahoma	357, 893, 000	53, 528, 000	348, 116, 000	47, 032, 000
Pennsylvania	101, 951, 000	48, 821, 000	85, 716, 000	44, 521, 000
South Dakota	99, 000	40, 000	98, 000	52, 000
Tennessee	25, 000	10, 700	24, 000	9, 000
Texas	464, 928, 000	67, 474, 000	517, 880, 000	71, 873, 000
Utah	693, 000	205, 000	393, 000	125, 000
West Virginia	167, 333, 000	73, 793, 000	144, 180, 000	66, 553, 000
Wyoming	44, 648, 000	3, 850, 000	43, 219, 000	4, 277, 000
Other [1]	28, 000	5, 900	125, 000	51, 000
	1, 917, 693, 000	413, 276, 000	1, 943, 421, 000	416, 090, 000

[1] Alaska, Iowa, North Dakota, and Washington.

GASOLINE FROM NATURAL GAS

Natural gasoline produced in the United States, 1921–1930

Year	Natural gasoline produced		Natural gas treated (estimated) (M cubic feet)
	Gallons	Value at plant	
1921	449, 934, 402	$61, 815, 258	465, 097, 000
1922	505, 832, 000	72, 711, 063	545, 139, 000
1923	816, 226, 000	77, 268, 000	875, 711, 000
1924	933, 861, 000	82, 233, 000	1, 016, 276, 000
1925	1, 127, 470, 000	120, 383, 000	1, 040, 390, 000
1926	1, 373, 090, 000	136, 412, 000	1, 206, 300, 000
1927	1, 641, 144, 000	118, 688, 000	1, 341, 248, 000
1928	1, 814, 034, 000	138, 944, 000	1, 473, 434, 000
1929	2, 233, 688, 000	158, 410, 000	1, 959, 294, 000
1930	2, 210, 494, 000	128, 160, 000	2, 088, 778, 000

Natural gasoline produced in the United States, 1929 and 1930, by States

State	1929		1930	
	Gallons	Value	Gallons	Value
Alaska	35, 000	$4, 000	39, 000	$5, 000
Arkansas	33, 455, 000	2, 419, 000	30, 637, 000	1, 757, 000
California	840, 325, 000	67, 009, 000	829, 713, 000	57, 974, 000
Colorado	1, 630, 000	113, 000	1, 322, 000	69, 000
Illinois	7, 080, 000	617, 000	6, 867, 000	420, 000
Indiana	2, 000	(1)	2, 000	(1)
Kansas	36, 227, 000	2, 207, 000	35, 106, 000	1, 570, 000
Kentucky	6, 006, 000	486, 000	6, 641, 000	385, 000
Louisiana	64, 957, 000	4, 010, 000	73, 693, 000	3, 725, 000
New Mexico	1, 077, 000	71, 000	3, 663, 000	169, 000
New York	264, 000	22, 000	208, 000	19, 000
Ohio	11, 166, 000	923, 000	8, 937, 000	605, 000
Oklahoma	676, 030, 000	42, 766, 000	591, 194, 000	29, 148, 000
Pennsylvania	18, 411, 000	1, 676, 000	16, 713, 000	1, 229, 000
Texas	419, 485, 000	26, 561, 000	491, 299, 000	23, 596, 000
West Virginia	72, 994, 000	6, 285, 000	63, 328, 000	4, 151, 000
Wyoming	44, 544, 000	3, 241, 000	51, 132, 000	3, 338, 000
	2, 233, 688, 000	158, 410, 000	2, 210, 494, 000	128, 160, 000

[1] Less than $500.

GEMS AND PRECIOUS STONES

Value of precious stones produced in the United States, 1921 to 1923, was as follows: 1921, $518,280 (exclusive of diamond in Arkansas, not reported); 1922, $71,106 (exclusive of diamond in Arkansas, not reported); 1923, $65,000 (estimate). Canvass discontinued after 1923.

Value of diamonds and other precious stones imported for consumption in the United States, 1921–1930

Year	Diamonds				Other stones not set	Total, excluding pearls	Pearls
	Glazier's	Dust and bort	Rough or uncut	Cut but not set			
1921	$435, 872	$466, 345	$2, 207, 365	$26, 144, 323	$2, 778, 931	$32, 032, 836	$4, 492, 063
1922	839, 882	1, 029, 261	8, 332, 416	43, 144, 742	3, 723, 062	57, 069, 363	8, 546, 574
1923	1, 065, 834	228, 409	7, 241, 550	51, 975, 896	5, 703, 279	66, 214, 968	7, 932, 929
1924	1, 116, 862	259, 482	11, 666, 587	47, 108, 169	5, 214, 130	65, 365, 230	5, 898, 560
1925	1, 976, 640	760, 476	9, 492, 328	49, 723, 818	5, 228, 011	67, 181, 273	6, 734, 149
1926	1, 939, 735	271, 382	13, 070, 767	51, 353, 168	6, 333, 779	72, 968, 831	5, 322, 140
1927	2, 148, 275	62, 045	11, 452, 439	40, 714, 672	4, 529, 350	58, 906, 781	6, 043, 162
1928	2, 756, 895	31, 222	11, 903, 815	42, 368, 172	3, 822, 140	60, 882, 244	7, 082, 034
1929	4, 067, 674	89, 363	9, 588, 137	41, 828, 581	9, 398, 183	64, 971, 938	10, 345, 420
1930	2, 756, 630	90, 945	5, 769, 566	23, 405, 415	3, 971, 095	35, 993, 651	2, 648, 042

Domestic exports in 1922 were as follows: "Diamonds, cut but not set," 15 carats, valued at $1,540; "other precious stones, including pearls," $21,525. Data are not separately recorded prior to 1922. For 1923 to 1930, domestic exports are recorded as "Precious stones, including pearls," as follows: 1923, $78,967; 1924, $146,825; 1925, $39,823; 1926, $64,377; 1927, $87,291; 1928, $72,296; 1929, $47,316; 1930, $136,253.

Value of foreign precious stones reexported from the United States, 1921–1930

Year	Diamonds [1]		Other precious stones [1]		Total, excluding pearls	Pearls and parts of, not strung or set
	Uncut	Cut but not set	Uncut [1]	Cut but not set		
1921		$896	[1] $14,390	$9,353	$24,639	$128
1922	$19,735	1,496	[1] 7,787	7,046	36,064	728
1923–1930	(2)	(2)	(2)	(2)	(2)	(2)

[1] Bort included under "Other precious stones—uncut."

[2] Foreign exports for 1923 to 1925 are recorded as "Diamonds and precious stones," as follows: 1923, 35,840 carats, valued at $27,123; 1924, 47,797 carats, $69,230; 1925, 32,079 carats, $26,983. Beginning 1926 they are recorded as "Precious stones and imitations," and valued as follows: 1926, $27,304; 1927, $62,494; 1928, $42,513; 1929, $41,845; 1930, $277,145.

GOLD AND SILVER [1]

Gold and silver produced in the United States, 1921–1930

Year	Gold		Silver	
	Troy ounces	Value	Troy ounces	Value
1921	2,422,006	$50,067,300	53,052,441	$53,052,441
1922	2,365,075	48,849,100	56,240,048	56,240,048
1923	2,502,632	51,734,000	73,335,170	60,134,859
1924	2,528,900	52,277,000	65,407,186	43,822,814
1925	2,411,987	49,860,200	66,155,424	45,911,864
1926	2,335,042	48,269,600	62,718,746	39,136,497
1927	2,197,125	45,418,600	60,434,441	34,266,328
1928	2,233,251	46,165,400	58,462,507	34,200,567
1929	2,208,386	45,651,400	61,327,868	32,687,754
1930	2,285,603	47,247,600	50,748,127	19,538,029

[1] Gold is valued by law at $20.67+ a troy ounce. For prices of silver, see statement on p. A14.

Gold produced in the United States, 1929 and 1930, by States [1]

State	1929		1930	
	Troy ounces	Value [2]	Troy ounces	Value [2]
Alabama	10	$200	10	$200
Alaska	374,669	7,745,100	407,356	8,420,800
Arizona	211,108	4,364,000	148,681	3,073,500
California	409,020	8,455,200	450,289	9,308,300
Colorado	220,285	4,553,700	218,258	4,511,800
Georgia	58	1,200	203	4,200
Idaho	19,597	405,100	21,198	438,200
Montana	55,854	1,154,600	46,900	969,500
Nevada	158,941	3,285,600	140,220	2,898,600
New Mexico	33,026	682,700	31,589	653,000
North Carolina	174	3,600	498	10,300
Oregon	17,657	365,000	14,300	295,600
Pennsylvania	745	15,400	610	12,600
Philippine Islands	151,757	3,137,100	185,208	3,828,600
South Dakota	312,328	6,456,400	406,297	8,398,900
Tennessee	653	13,500	721	14,900
Texas	1,263	26,100	242	5,000
Utah	237,221	4,903,800	208,936	4,319,100
Washington	3,972	82,100	3,647	75,400
Wyoming	48	1,000	440	9,100
	2,208,386	45,651,400	2,285,603	47,247,600

[1] Figures furnished by the Bureau of the Mint.

[2] Gold value, $20.67+ a troy ounce.

Silver produced in the United States, 1929 and 1930, by States [1]

State	1929		1930	
	Troy ounces	Value [2]	Troy ounces	Value [2]
Alaska	478, 973	$255, 293	392, 024	$150, 929
Arizona	7, 840, 321	4, 178, 891	4, 910, 394	1, 890, 502
California	1, 194, 651	636, 749	1, 434, 126	552, 139
Colorado	4, 415, 838	2, 353, 642	4, 851, 571	1, 867, 855
Georgia	13	7	23	9
Idaho	9, 533, 327	5, 081, 263	9, 710, 150	3, 738, 408
Illinois	4, 146	2, 210	1, 896	730
Michigan	17, 899	9, 540	10, 720	4, 127
Missouri	146, 638	78, 158	187, 548	72, 206
Montana	12, 613, 580	6, 723, 038	8, 596, 966	3, 309, 832
Nevada	4, 746, 750	2, 530, 018	4, 178, 943	1, 608, 893
New Mexico	1, 060, 494	565, 243	1, 160, 374	446, 744
North Carolina	14, 414	7, 683	32, 891	12, 663
Oregon	37, 840	20, 169	9, 816	3, 779
Pennsylvania	5, 616	2, 993	4, 538	1, 747
Philippine Islands	94, 547	50, 394	120, 884	46, 540
South Dakota	84, 465	45, 020	105, 166	40, 489
Tennessee	96, 146	51, 246	85, 533	32, 930
Texas	1, 042, 273	555, 531	468, 736	180, 463
Utah	17, 844, 657	9, 511, 202	14, 451, 266	5, 563, 738
Vermont	3, 633	1, 936	4, 512	1, 737
Washington	51, 639	27, 524	29, 853	11, 493
Wyoming	8	4	197	76
	61, 327, 868	32, 687, 754	50, 748, 127	19, 538, 029

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[1] Figures furnished by the Bureau of the Mint.

[2] Valued at average New York price of bar silver, as follows: 1929, 53.3 cents an ounce; 1930, 38.5 cents an ounce.

Value of gold and silver imported into and exported from the United States, 1921–1930

Year	Gold		Silver	
	Imports	Exports	Imports	Exports
1921	$691, 248, 297	$23, 891, 377	$63, 242, 671	$51, 575, 399
1922	275, 169, 785	36, 874, 894	70, 806, 653	62, 807, 286
1923	322, 715, 812	28, 643, 417	74, 453, 530	72, 468, 789
1924	319, 720, 918	61, 648, 313	73, 944, 902	109, 891, 033
1925	128, 273, 172	262, 639, 790	64, 595, 418	99, 127, 585
1926	213, 504, 020	115, 707, 815	69, 595, 936	92, 257, 564
1927	207, 535, 195	201, 455, 100	55, 073, 917	75, 624, 780
1928	168, 897, 307	560, 759, 341	68, 117, 329	87, 382, 016
1929	291, 648, 632	116, 582, 926	63, 939, 830	83, 407, 197
1930	396, 053, 695	115, 967, 332	42, 760, 841	54, 156, 584

Value of gold and silver imported into and exported from the United States, 1929 and 1930, by classes

	Imports	Exports	Excess of—	
			Imports	Exports
1929				
Gold:				
Contained in domestic ore and base bullion		$57, 787		$57, 787
Contained in foreign ore and base bullion	$17, 459, 761		$17, 459, 761	
Domestic bullion refined	28, 129, 908	109, 228, 470		81, 098, 562
Foreign bullion refined	129, 962, 247	1, 372	129, 960, 875	
United States coin	96, 920, 998	7, 145, 173	89, 775, 825	
Foreign coin	19, 175, 718	150, 124	19, 025, 594	
	291, 648, 632	116, 582, 926	256, 222, 055	81, 156, 349
Excess imports over exports			175, 065, 706	
Silver:				
Contained in domestic ore and base bullion		5, 202		5, 202
Contained in foreign ore and base bullion	33, 487, 387		33, 487, 387	
Domestic bullion refined		62, 788, 418		62. 788, 418
Foreign bullion refined	24, 994, 216	13, 515, 301	11, 478, 915	
United States coin	2, 068, 861	44, 131	2, 024, 730	
Foreign coin	3, 389, 366	7, 054, 145		3, 664, 779
	63, 939, 830	83, 407, 197	46, 991, 032	66, 458, 399
Excess exports over imports				19, 467, 367
1930				
Gold:				
Contained in domestic ore and base bullion		43. 826		43. 826
Contained in foreign ore and base bullion	17, 565, 829		17, 565, 829	
Domestic bullion refined	9, 465, 478	75, 452, 202		65, 986, 724
Foreign bullion refined	47, 012, 149		47, 012, 149	
United States coin	160, 801, 740	39, 219, 063	121, 582, 677	
Foreign coin	161, 208, 499	1, 252, 241	159, 956, 258	
	396, 053, 695	115, 967, 332	346, 116, 913	66, 030, 550
Excess imports over exports			280, 086, 363	
Silver:				
Contained in domestic ore and base bullion		1, 546		1, 546
Contained in foreign ore and base bullion	21, 275, 154		21, 275, 154	
Domestic bullion refined	76, 537	43, 502, 964		43, 426, 427
Foreign bullion refined	17, 825. 676	7, 392, 959	10, 432, 717	
United States coin	1, 810, 222	45, 076	1, 765, 146	
Foreign coin	1, 773, 252	3, 214, 039		1, 440, 787
	42, 760, 841	54, 156, 584	33, 473, 017	44, 868, 760
Excess exports over imports				11, 395, 743

GRAPHITE

Natural graphite sold or used by producers in the United States, 1921–1930

Year	Amorphous		Crystalline	
	Short tons	Value	Pounds	Value
1921	1, 842	$20, 860	1, 189, 523	$75, 664
1922	2, 200	(1)	1, 849, 766	85, 242
1923	4, 056	39, 560	3, 964, 900	151, 434
1924	4, 071	38, 533	1, 800, 325	48, 977
1925	3, 526	39, 040	2, 257, 250	56, 721
1926	2, 975	40, 500	4, 989, 200	178, 842
1927	2, 595	35, 850	5, 221, 400	197, 121
1928	2, 954	43, 320	5, 233, 300	253, 773
1929	3, 555	46, 650	5, 806, 410	264, 241
1930	1, 941	20, 525	(1)	(1)

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[1] Bureau of Mines not at liberty to publish figures.

Graphite imported for consumption in the United States, 1921–1930, by kinds

Year	Amorphous		Crystalline chip or dust		Crystalline flake		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	(1)	(1)	(1)	(1)	(1)	(1)	8,183	$452,076
1922							12,488	473,046
1923	11,252	$149,831	7,243	$426,417	939	$37,871	19,434	614,119
1924	10,936	113,751	3,998	197,867	1,441	87,893	16,375	399,511
1925 [2]	9,210	143,750	5,904	389,242	2,654	293,418	17,768	[2] 826,410
1926 [2]	8,250	161,564	5,258	433,848	2,658	325,821	16,166	[2] 921,233
1927 [2]	9,559	146,881	6,116	390,822	1,777	186,220	17,452	[2] 723,923
1928 [2]	7,699	107,936	7,143	452,424	2,727	241,199	17,569	[2] 801,559
1929 [2]	12,041	189,198	8,304	546,668	3,727	330,968	24,072	[2] 1,066,834
1930 [2]	10,926	212,614	3,071	186,616	2,729	225,438	16,726	[2] 624,668

[1] Not separately recorded prior to 1923.

[2] Imports of graphite crucibles were not separately recorded until 1925 when 3,100 crucibles, valued at $548, were imported; corresponding imports for 1926 were 9,513 crucibles, $11,780; for 1927, 2,583 crucibles, $1,812; for 1928, 2,368 crucibles, $1,245; for 1929, 7,640 crucibles, $1,156; and for 1930, 25,976 crucibles, $3,218; weight not recorded.

Graphite exported from the United States, 1921–1930

Year	Unmanufactured graphite		Manufactures of graphite [1]	Year	Unmanufactured graphite		Manufactures of graphite [1]
	Short tons	Value			Short tons	Value	
1921	921	$95,998	$679,359	1926	405	$49,235	$463,084
1922	569	78,094	255,019	1927	[2] 1,819	[2] 435,997	(2)
1923	908	138,542	335,778	1928	[2] 2,203	[2] 454,770	(2)
1924	1,022	144,108	250,957	1929	[2] 1,613	[2] 370,013	(2)
1925	945	142,122	337,481	1930	[2] 1,556	[2] 418,430	(2)

[1] After 1921, exclusive of crucibles, figures for which are not available.

[2] Classification beginning 1927 reads "Graphite and manufactures, except crucibles."

GRINDSTONES AND PULPSTONES

[See Abrasive materials]

GYPSUM

Gypsum produced in the United States and sold by producers, 1921–1930

Year	Crude produced (short) tons)	Crude and calcined sold (total value)	Year	Crude produced (short tons)	Crude and calcined sold (total value)
1921	2,890,784	$23,700,290	1926	5,635,441	$46,721,219
1922	3,779,949	29,361,151	1927	5,346,888	42,174,454
1923	4,753,448	34,888,155	1928	5,102,250	32,036,163
1924	5,042,629	42,724,507	1929	5,016,132	31,292,969
1925	5,678,302	47,577,240	1930	3,471,393	27,051,484

Gypsum imported for consumption in the United States, 1921–1930

Year	Crude		Ground or calcined		Value of manufactured plaster of Paris	Keenes cement		Total value
	Short tons	Value	Short tons	Value		Short tons	Value	
1921	266,796	$364,318	4,495	$55,109	$33,072	184	$6,836	$459,335
1922	409,475	523,939	1,774	32,651	55,116	403	9,636	621,342
1923	448,129	629,203	5,133	77,716	41,317	418	11,543	759,779
1924	519,627	724,864	5,217	70,793	48,059	539	12,042	855,758
1925	634,423	915,888	10,759	140,941	56,724	449	11,294	1,124,847
1926	824,081	1,276,131	7,149	99,058	96,355	578	15,701	1,487,245
1927	828,619	1,167,581	8,650	114,947	89,096	655	16,202	1,387,826
1928	1,028,816	1,340,920	6,907	99,833	87,314	601	13,729	1,541,796
1929	1,036,385	1,060,874	4,979	69,703	71,479	430	11,327	1,213,383
1930	902,358	916,663	6,562	75,959	61,322	1,146	37,175	1,091,119

Gypsum and gypsum products exported from the United States, 1922-1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1922	7, 673	$178, 166	1927	18, 429	$471, 106
1923	8, 815	226, 423	1928	18, 788	416, 748
1924	10, 623	358, 425	1929	28, 809	512, 186
1925	16, 798	498, 616	1930	23, 611	420, 728
1926	19, 610	576, 585			

[1] Exports of gypsum not separately recorded prior to 1922. For 1927 and earlier years the classification read "Gypsum or plaster, crude, ground, calcined, and manufactures of." For 1928 to 1930 exports are recorded as follows: "Crude, crushed, or ground," 2,365 short tons, valued at $23,764, in 1928; 4,230 tons, $30,870, in 1929; and 3,603 tons, $22,918, in 1930; and "Plaster, calcined, and manufactures, n. e. s.," 16,423 tons, $392,984, in 1928; 24,579 tons, $481,316, in 1929; and 20,008 tons, $397,810, in 1930.

ILMENITE

[See Titanium minerals]

IRON ORE, PIG IRON, AND STEEL

IRON ORE

[Exclusive of all domestic ore containing 5 per cent or more of manganese. For data regarding such ore see Manganese]

Iron ore mined in the United States, 1921–1930, by varieties, in long tons

Year	Hematite	Brown ore	Magnetite	Carbonate	Total
1921	[1] [2] 28, 337, 249	[2] 370, 154	[1] 780, 866	2, 709	29, 490, 978
1922	[2] 44, 888, 723	[2] 783, 582	1, 452, 966	3, 256	47, 128, 527
1923	[2] 65, 924, 454	[2] 1, 232, 848	2, 190, 624	3, 516	69, 351, 442
1924	[2] 52, 102, 300	[2] 814, 159	1, 347, 711	3, 249	54, 267, 419
1925	[2] 59, 546, 690	[2] 884, 600	1, 472, 004	4, 703	61, 907, 997
1926	[2] [3] 64, 634, 573	[2] 810, 924	[3] 2, 175, 288	2, 215	67, 623, 000
1927	[2] [3] 58, 505, 543	[2] 743, 478	[3] 2, 489, 586	2, 493	61, 741, 100
1928	[3] 59, 207, 857	816, 637	[3] 2, 170, 804	1, 790	62, 197, 088
1929	[2] [3] 69, 849, 231	[2] 775, 610	[3] 2, 401, 104	1, 775	73, 027, 720
1930	[2] [3] 55, 265, 954	[2] 720, 496	[3] 2, 421, 211	1, 003	58, 408, 664

[1] Some magnetite included with hematite.
[2] Some hematite included with brown ore.
[3] Some hematite included with magnetite.

Iron ore mined in the United States, 1929 and 1930, by mining districts and varieties, in long tons

District	Hematite	Brown ore	Magnetite	Carbonate	Total
1929					
Lake Superior [1]	62, 824, 768				62, 824, 768
Birmingham	5, 814, 143	467, 422			6, 281, 565
Chattanooga	81, 524	74, 429			155, 953
Adirondack			[2] 749, 976		[2] 749, 976
Northern New Jersey and southeastern New York			353, 612		353, 612
Other districts	[2] [3] 1, 128, 796	[3] 233, 759	1, 297, 516	1, 775	[2] 2, 661, 846
	[2] [3] 69, 849, 231	[3] 775, 610	[2] 2, 401, 104	1, 775	73, 027, 720
1930					
Lake Superior [1]	49, 382, 652				49, 382, 652
Birmingham	5, 151, 089	400, 595			5, 551, 684
Chattanooga	326	73, 925			74, 251
Adirondack			[2] 833, 225		[2] 833, 225
Northern New Jersey and southeastern New York			450, 819		450, 819
Other districts	[2] [3] 731, 887	[3] 245, 976	1, 137, 167	1, 003	[2] 2, 116, 033
	[2] [3] 55, 265, 954	[3] 720, 496	[2] 2, 421, 211	1, 003	58, 408, 664

[1] Includes only those mines in Wisconsin which are in the true Lake Superior district.
[2] Some hematite from "Other districts" included with magnetite from Adirondack district.
[3] Some hematite included with brown ore.

Iron ore mined in the Lake Superior district, 1921–1930, by ranges, in long tons

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1921	2,204,114	2,147,569	3,135,477	981,576	16,380,190	449,559	25,298,485
1922	2,745,626	3,290,641	4,910,789	1,108,764	26,704,601	955,595	39,716,016
1923	3,910,909	4,913,541	6,112,662	1,119,113	41,809,018	1,420,165	59,285,408
1924	3,579,087	3,780,664	5,579,883	1,141,690	29,818,965	941,430	44,841,719
1925	3,813,687	5,009,022	6,377,710	1,331,753	34,851,109	673,382	52,056,663
1926	4,046,191	5,445,683	6,949,920	1,568,953	37,997,797	1,134,863	57,143,407
1927	4,015,730	5,458,182	6,604,830	1,577,817	32,866,034	1,017,287	51,539,880
1928	3,755,343	4,855,735	6,342,092	1,628,289	34,856,333	1,079,383	52,517,175
1929	4,545,839	5,428,469	7,089,602	1,883,547	42,371,192	1,506,119	62,824,768
1930	4,419,816	4,431,077	6,014,011	1,996,516	31,299,900	1,221,332	49,382,652

Iron ore shipped from mines in the United States, 1921–1930

[Exclusive of ore sold for paint. See p. A66]

Year	Long tons	Value	Year	Long tons	Value
1921	26,652,528	$89,745,308	1926	69,292,832	$174,015,645
1922	50,612,620	157,809,286	1927	61,232,473	151,125,820
1923	69,811,472	240,738,921	1928	63,432,826	155,788,657
1924	52,083,375	151,307,105	1929	75,602,734	197,148,640
1925	63,924,763	160,796,886	1930	55,201,221	145,619,059

Iron ore shipped from mines in the United States, 1929 and 1930, by States

[Exclusive of ore sold for paint. See p. A66]

State	1929		1930	
	Long tons	Value	Long tons	Value
Alabama	6,637,299	$12,575,113	5,637,678	$11,015,336
Arizona	----------	----------	923	(1)
Colorado	50,754	(1)	32,247	(1)
Georgia	59,316	175,145	52,221	147,964
Michigan	16,838,568	47,597,976	11,154,773	31,515,996
Minnesota	46,470,243	121,776,312	34,165,777	90,835,451
Missouri	171,456	661,055	132,749	508,354
New Jersey	285,115	1,157,848	391,528	1,632,827
New Mexico	171,585	(1)	173,432	(1)
New York	875,564	3,941,985	755,074	3,663,155
North Carolina	30,575	106,411	----------	----------
Pennsylvania	1,151,130	2,382,839	894,039	1,850,661
Tennessee	101,796	234,827	27,384	76,089
Utah	324,885	(1)	278,918	(1)
Virginia	232	631	36,178	65,528
Washington	5,018	(1)	----------	----------
Wisconsin	1,789,721	4,848,978	1,148,277	3,179,175
Wyoming	639,477	(1)	320,023	(1)
Undistributed	----------	[2] 1,689,520	----------	[2] 1,128,523
	75,602,734	197,148,640	55,201,221	145,619,059

(1) Included under "Undistributed."

[2] This figure covers States entered as "(1)" above.

Stocks of iron ore at mines in the United States, December 31, 1921–1930, in long tons

1921	13,836,267	1926	9,565,880
1922	10,524,279	1927	10,104,673
1923	10,165,875	1928	9,190,061
1924	12,410,619	1929	7,067,206
1925	10,795,630	1930	10,383,152

Stocks of iron ore at mines in the United States, December 31, 1929 and 1930, in long tons

State	1929	1930	State	1929	1930
Alabama	807, 231	909, 493	North Carolina	100	200
Iowa	12, 165	12, 165	Pennsylvania	32, 719	103, 183
Michigan	4, 267, 279	6, 654, 663	Virginia	20, 955	3, 478
Minnesota	1, 712, 426	2, 171, 194	Wisconsin	127, 794	303, 183
New Jersey	62, 173	65, 163			
New York	24, 104	160, 430		7, 067, 206	10, 383, 152

Iron ore imported into and exported from the United States, 1921–1930

Year	Imports		Exports	
	Long tons	Value	Long tons	Value
1921	315, 768	$1, 075, 909	440, 106	$2, 077, 620
1922	1, 135, 156	4, 916, 294	602, 194	2, 770, 878
1923	2, 708, 430	11, 308, 593	1, 116, 972	5, 305, 365
1924	2, 047, 055	10, 580, 904	595, 413	2, 407, 003
1925	2, 196, 697	6, 895, 229	630, 521	2, 411, 093
1926	2, 555, 441	5, 876, 316	868, 710	3, 380, 701
1927	2, 620, 717	6, 068, 283	898, 793	3, 425, 435
1928	2, 452, 646	5, 428, 019	1, 282, 306	4, 797, 881
1929	3, 139, 334	8, 145, 354	1, 304, 417	4, 774, 842
1930	2, 775, 124	8, 113, 039	752, 207	2, 734, 168

PIG IRON

Pig iron shipped from blast furnaces in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	16, 038, 619	$389, 437, 792	1926	38, 181, 053	$749, 633, 468
1922	27, 670, 738	608, 144, 858	1927	34, 866, 644	646, 226, 139
1923	38, 361, 379	946, 799, 378	1928	38, 303, 699	661, 351, 270
1924	31, 064, 129	665, 078, 972	1929	41, 549, 161	731, 858, 075
1925	36, 814, 702	739, 316, 333	1930	29, 905, 355	512, 165, 131

Pig iron shipped from blast furnaces in the United States, 1929 and 1930, by States

State	1929		1930	
	Long tons	Value	Long tons	Value
Alabama	2, 697, 814	$43, 674, 910	2, 294, 513	$31, 083, 905
Colorado	(1)	(1)	(1)	(1)
Illinois	4, 316, 096	79, 672, 295	3, 050, 743	54, 290, 144
Indiana	4, 279, 825	71, 416, 732	3, 195, 517	52, 869, 137
Kentucky	194, 150	(1)	85, 328	(1)
Maryland	1, 111, 219	(1)	981, 466	(1)
Massachusetts	(1)	(1)	(1)	(1)
Michigan	841, 089	14, 099, 647	711, 224	12, 859, 820
Minnesota	376, 551	(1)	266, 622	(1)
New Jersey	294	(1)	405	(1)
New York	2, 626, 771	46, 960, 186	1, 638, 323	29, 160, 894
Ohio	9, 446, 984	163, 480, 003	6, 541, 212	111, 529, 209
Pennsylvania	14, 058, 194	257, 154, 601	9, 734, 591	176, 521, 843
Tennessee	104, 985	1, 998, 238	42, 197	828, 716
Utah	(1)	(1)	(1)	(1)
Virginia	44, 512	(1)	50, 629	(1)
West Virginia	653, 048	(1)	704, 654	(1)
Undistributed	[2] 797, 719	[2] 53, 461, 463	[2] 607, 931	[2] 43, 021, 463
	41, 549, 161	731, 858, 075	29, 905, 355	512, 165, 131

[1] Included under "Undistributed."

[2] This figure covers States entered as "(1)" above.

Pig iron[1] *imported into and exported from the United States, 1921–1930*

Year	Imports		Exports	
	Long tons	Value	Long tons	Value
1921[1]	44,036	$2,014,926	28,307	$933,093
1922	383,445	8,670,860	30,920	756,842
1923	367,778	9,005,077	32,318	862,443
1924	209,109	3,741,213	41,483	957,921
1925	441,425	7,951,283	32,674	724,565
1926	445,773	7,708,982	25,208	523,883
1927	132,568	2,254,355	50,992	1,028,425
1928	140,694	2,232,094	84,682	1,366,794
1929	147,763	2,398,488	46,357	830,225
1930	137,031	1,806,754	13,671	291,683

[1] Figures for 1921 include ferro-alloys. Separate data not available prior to 1922.

STEEL

Steel produced in the United States, 1921–1930, in long tons[1]

Year	Bessemer	Open hearth	Crucible	Other steel	Total
1921	4,015,938	15,589,802	7,613	170,444	19,783,797
1922	5,919,298	29,308,983	28,606	346,039	35,602,926
1923	8,484,088	35,899,657	44,079	515,872	44,943,696
1924	5,899,590	31,577,350	22,473	432,526	37,931,939
1925	6,723,962	38,034,488	19,562	615,512	45,393,524
1926	6,934,568	40,691,979	15,493	651,723	48,293,763
1927	6,191,727	38,068,335	9,036	666,087	44,935,185
1928	6,620,195	44,113,956	7,769	802,260	51,544,180
1929	7,122,509	48,352,888	6,645	951,431	56,433,473
1930	5,035,459	35,049,172	2,253	612,599	40,699,483

[1] According to the American Iron and Steel Institute.

LEAD[1]

Refined primary lead produced in the United States from domestic ores, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	398,222	$35,840,000	1926	680,685	$108,910,000
1922	468,746	51,562,000	1927	668,320	84,208,000
1923	543,841	76,138,000	1928	626,202	72,639,000
1924	566,407	90,625,000	1929	672,498	84,735,000
1925	654,921	113,956,000	1930	573,740	57,374,000

[1] For prices of lead, see statement on p. A14.

Refined primary lead produced in the United States, 1926–1930, in short tons

	1926	1927	1928	1929	1930
Domestic ore:					
Desilverized lead	366, 413	378, 889	351, 734	381, 487	326, 801
Soft lead	258, 565	233, 944	225, 003	235, 345	201, 361
Desilverized soft lead	55, 707	55, 487	49, 465	55, 666	45, 578
Total from domestic ore	680, 685	668, 320	626, 202	672, 498	573, 740
Foreign ore:					
Africa	6	12			
Canada	5, 385	4, 138	10, 123	9, 499	14, 369
Central America		18	3		
Mexico	32, 693	22, 674	14, 839	16, 807	14, 949
South America	9, 893	5, 506	1, 568	3, 285	3, 476
Other foreign	233	21	99	84	1, 554
Foreign base bullion:					
Mexico	70, 046	95, 841	117, 193	51, 295	18, 592
Peru			11, 044	21, 165	16, 353
Total from foreign ore and base bullion	118, 256	128, 210	154, 869	102, 135	69, 293
Grand total from all sources	798, 941	796, 530	781, 071	774, 633	643, 033
Production of antimonial lead	22, 524	24, 347	33, 058	25, 669	13, 711

Secondary lead recovered in the United States, 1921–1930

Year	Pig lead (short tons)	Lead in alloys (short tons)	Total	
			Short tons	Value
1921	46, 370	57, 410	103, 780	$9, 340, 000
1922	75, 480	84, 080	159, 560	17, 552, 000
1923	96, 430	98, 060	194, 490	27, 229, 000
1924	90, 400	114, 100	204, 500	32, 720, 000
1925	112, 420	114, 460	226, 880	39, 477, 100
1926	125, 000	152, 300	277, 300	44, 368, 000
1927	119, 000	157, 000	276, 000	34, 776, 000
1928	138, 000	170, 600	308, 600	35, 797, 600
1929	138, 500	172, 500	311, 000	39, 186, 000
1930	129, 000	126, 800	255, 800	25, 580, 000

Lead imported for consumption in the United States, 1921–1930, by classes

Year	Lead in ore [1]		Lead in base bullion		Pigs, bars, and old [2]		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value		
1921	6, 842, 807	$327, 046	56, 819, 980	$1, 668, 410	61, 909, 094	$1, 972, 716	3, 087	$140	$11, 204	$3, 979, 516
1922	23, 649, 851	812, 603	55, 859, 422	1, 815, 142	8, 563, 110	335, 924	6, 018	697	12, 286	2, 976, 652
1923	22, 420, 046	1, 190, 414	11, 124, 151	626, 201	42, 925, 265	2, 510, 466	19, 525	4, 495	90, 027	4, 421, 603
1924	65, 147, 976	3, 145, 791	28, 796, 402	1, 542, 167	27, 362, 392	1, 850, 862	11, 666	4, 384	138, 637	6, 681, 841
1925	12, 706, 508	672, 112	24, 747, 665	1, 823, 566	15, 464, 205	1, 038, 350	27, 579	10, 429	139, 533	3, 683, 990
1926	58, 752, 911	3, 393, 039	13, 341, 038	972, 758	24, 365, 570	2, 191, 658	864, 342	101, 322	62, 895	6, 721, 672
1927	70, 260, 478	4, 203, 897	14, 629, 606	925, 328	9, 933, 679	635, 807	988, 170	104, 890	52, 626	5, 922, 548
1928	46, 511, 508	2, 626, 231	13, 397, 455	560, 983	20, 488, 373	808, 359	775, 329	67, 131	134, 995	4, 197, 699
1929	21, 645, 699	1, 160, 533	12, 395, 696	627, 455	20, 178, 922	1, 052, 087	899, 595	78, 776	126, 966	3, 045, 817
1930	30, 915, 964	1, 461, 350	20, 846, 713	1, 127, 920	1, 141, 442	60, 493	908, 809	78, 737	87, 612	2, 816, 112

[1] Includes also lead in matte beginning Sept. 22, 1922, when change in tariff went into effect.

[2] Includes also imports of antimonial lead, antimonial scrap lead, babbitt metal, solder, etc., from Sept. 22, 1922, when change in tariff went into effect, through 1924; from 1925 to 1930, inclusive, antimonial lead is excluded.

Lead imported into the United States in ore, base bullion, and refined, 1926–1930, by sources, in pounds

[General imports]

Year	Canada	Mexico	South America	Europe	Other countries	Total
1926	12, 316, 740	254, 203, 852	24, 790, 075	3, 224, 504	572, 856	295, 108, 027
1927	6, 214, 867	300, 634, 815	14, 583, 513	1, 226, 049	118, 883	322, 778, 127
1928	14, 352, 967	275, 184, 287	20, 408, 574	56, 406	85, 915	310, 088, 149
1929	9, 023, 527	175, 872, 302	47, 052, 018	29, 441	141, 480	232, 118, 768
1930	34, 536, 897	73, 442, 591	44, 943, 694	226, 294	3, 283, 888	156, 433, 364

Lead imported into the United States, 1926–1930, by classes, in pounds

[General imports]

Year	Lead in ore	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1926	116, 232, 669	156, 570, 738	22, 304, 620	295, 108, 027
1927	81, 276, 126	236, 567, 252	4, 934, 749	322, 778, 127
1928	51, 829, 530	256, 935, 461	1, 323, 158	310, 088, 149
1929	62, 661, 371	166, 141, 916	3, 315, 481	232, 118, 768
1930	78, 753, 878	77, 260, 580	418, 906	156, 433, 364

Lead exported from the United States, 1921–1930, by classes

Year	Pigs and bars				Foreign lead used in articles exported with benefit of drawback [1]	Manufactures of lead from both domestic and foreign ores
	From domestic ore		From foreign ore			
	Pounds	Value	Pounds	Value	Pounds	
1921	3, 247, 294	$177, 926	50, 000, 259	$2, 284, 107	18, 738, 927	$1, 376, 259
1922	11, 645, 821	604, 605	64, 709, 305	3, 177, 360	11, 354, 070	1, 158, 150
1923	3, 997, 485	260, 487	97, 471, 326	5, 195, 256	25, 052, 107	1, 078. 636
1924	10, 664, 083	711, 147	153, 515, 863	9, 685, 619	30, 549, 116	1, 965, 555
1925	9, 910, 955	784, 440	197, 128, 517	14, 910, 891	23, 398, 305	2, 006, 309
1926	8, 551, 639	601, 061	135, 319, 321	8, 904, 603	35, 910, 934	3, 297, 704
1927	5, 066, 035	308, 698	245, 467, 875	12, 508, 566	24, 008, 803	1, 318, 134
1928	28, 403, 279	1, 299, 021	204, 134, 083	9, 060, 200	26, 448, 902	1, 645, 909
1929	38, 515, 061	1, 918, 081	107, 985, 100	5, 260, 256	26, 171, 983	1, 634, 865
1930	8, 081, 117	374, 987	88, 532, 010	3, 529, 226	24, 322, 447	636, 021

[1] Exclusive of lead that entered as pig and was exported in the same form which would be duplicated in exports of lead from foreign ore.

LIME

Lime sold by producers in the United States, 1921–1930

Year	Hydrated			Total		
	Number of plants in operation	Short tons	Value [1]	Number of plants in operation	Short tons	Value [1]
1921	105	792, 970	$7, 421, 637	520	2, 532, 153	$24, 895, 370
1922	114	1, 106, 063	9, 868, 980	530	3, 639, 617	33, 255, 039
1923	121	1, 225, 928	12, 229, 598	467	4, 076, 243	39, 993, 652
1924	120	1, 316, 664	13, 199, 846	450	4, 072, 000	39, 596, 423
1925	134	1, 560, 848	15, 287, 461	450	4, 580, 823	42, 609, 141
1926	147	1, 606, 811	15, 182, 460	435	4, 560, 398	41, 566, 452
1927	157	1, 596, 906	14, 581, 695	417	4, 414, 932	38, 638, 413
1928	164	1, 612, 818	13, 540, 215	411	4, 458, 412	36, 449, 635
1929	157	1, 550, 771	12, 771, 525	381	4, 269, 768	33, 478, 848
1930	163	1, 329, 562	10, 357, 445	375	3, 387, 880	25, 616, 486

[1] The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Lime sold by producers in the United States, 1929 and 1930, by States

State	1929			1930		
	Number of plants in operation	Short tons	Value	Number of plants in operation	Short tons	Value
Alabama	10	209,260	$1,223,623	8	164,822	$929,30
Arizona	4	42,971	397,308	5	35,642	317,881
Arkansas	4	33,647	295,816	4	30,349	241,93
California	9	49,753	526,391	9	51,302	498,79
Colorado	4	7,046	76,791	4	6,777	73,15
Connecticut	4	35,180	386,855	4	28,489	282,521
Florida	2	(1)	(1)	2	(1)	(1)
Georgia	1	10,757	77,239	1	7,455	50,65
Hawaii	1	6,384	77,389	1	7,591	92,04
Idaho	1	(1)	(1)	3	2,463	25,156
Illinois	8	119,382	973,312	9	89,709	721,143
Indiana	8	116,795	786,814	9	87,965	600,784
Iowa	1	(1)	(1)	----------	----------	----------
Kentucky	1	(1)	(1)	2	(1)	(1)
Maine	4	92,428	772,443	3	66,775	542,115
Maryland	12	54,029	404,674	11	53,090	398,841
Massachusetts	7	133,644	1,443,984	7	107,502	1,072,008
Michigan	6	91,468	844,543	5	80,241	630,288
Minnesota	3	(1)	(1)	3	(1)	(1)
Missouri	13	316,579	2,319,886	14	265,771	1,861,105
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	1	(1)	(1)	1	(1)	(1)
New Jersey	1	1,644	15,618	1	(1)	(1)
New Mexico	2	(1)	(1)	4	2,369	21,446
New York	12	104,614	906,021	10	83,078	702,475
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	27	962,415	7,935,656	23	736,305	5,711,855
Oklahoma	1	(1)	(1)	1	(1)	(1)
Oregon	3	2,486	40,406	3	1,741	25,196
Pennsylvania	116	782,915	5,896,752	115	633,520	4,661,670
Porto Rico	12	10,114	131,887	12	9,764	130,680
Rhode Island	1	1,885	24,464	1	2,638	34,986
South Dakota	2	(1)	(1)	1	(1)	(1)
Tennessee	10	172,936	1,036,405	10	147,648	855,452
Texas	6	97,332	838,470	6	74,081	639,821
Utah	10	46,581	365,055	11	27,522	236,607
Vermont	7	53,128	505,246	8	45,963	406,921
Virginia	29	153,170	1,061,018	26	146,996	960,219
Washington	4	31,598	324,683	5	26,913	266,131
West Virginia	13	308,600	1,865,531	13	228,230	1,394,075
Wisconsin	18	130,902	1,094,388	16	64,989	598,739
Wyoming	----------	----------	----------	1	(1)	(1)
Undistributed	----------	90,125	830,180	----------	70,180	632,482
	381	4,269,768	33,478,848	375	3,387,880	25,616,486

[1] Included under "Undistributed."

Lime imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1921	10,811	$234,798	5,192	$109,769
1922	14,112	290,845	8,289	116,649
1923	25,407	428,903	11,789	170,289
1924	20,480	377,994	14,905	212,340
1925	15,323	285,599	14,800	218,696
1926	18,702	346,969	12,960	191,768
1927	19,567	356,836	15,478	210,977
1928	18,321	344,296	18,188	245,004
1929	21,501	390,736	17,334	239,440
1930	[1] 20,706	[1] 278,897	14,536	192,421

[1] Also 3,024 short tons of dead-burned dolomite, valued at $77,918, imported June 18 to Dec. 31, 1930; not separately recorded prior to change in tariff.

LITHIUM MINERALS

Lithium minerals produced in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	1,833	$33,508	1926	3,700	$53,400
1922	2,192	41,300	1927	4,173	59,656
1923	2,310	38,800	1928	4,600	94,750
1924	2,996	62,391	1929	(1)	(1)
1925	3,140	58,500	1930	1,797	56,327

[1] Bureau of Mines not at liberty to publish figures.

Imports and exports of lithium minerals are not separately recorded.

LITHOGRAPHIC STONE

No domestic production of lithographic stone in the United States has been reported since 1918.

Lithographic stone imported for consumption in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	301,546	$34,101	1926	248,698	$28,201
1922	256,426	28,242	1927	45,398	6,790
1923	225,600	24,861	1928	63,505	9,963
1924	133,674	9,046	1929	74,841	7,788
1925	186,971	20,263	1930	57,186	8,706

No exports of lithographic stone are reported.

MAGNESITE

Crude magnesite mined in the United States, 1921–1930[1]

Year	California		Washington		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	47,904	$510,177			47,904	$510,177
1922	[2] 55,790	[2] 571,745	(2)	(2)	55,790	571,745
1923	73,350	938,600	73,900	$165,100	147,250	1,103,700
1924	67,240	901,700	52,860	139,600	120,100	1,041,300
1925	64,600	872,100	56,060	560,600	120,660	1,432,700
1926	53,940	604,130	79,560	596,700	133,500	1,200,830
1927	43,750	507,500	77,740	583,050	121,490	1,090,550
1928	41,300	454,300	85,900	644,250	127,200	1,098,550
1929	[2] 187,660	[2] 1,500,000	(2)	(2)	187,660	1,500,000
1930	[2] 129,320	[2] 1,033,130	(2)	(2)	129,320	1,033,130

[1] Figures for 1921 and 1922 recorded as "Domestic magnesite (expressed as equivalent crude) sold or treated in the United States."

[2] Washington included with California. Bureau of Mines not at liberty to publish figures.

Magnesite imported for consumption in the United States, 1921–1930

Year	Crude		Calcined	
	Short tons	Value	Short tons	Value
1921	51,993	$525,452	6,788	$250,932
1922	73,331	976,283	72,265	1,267,622
1923	5,182	44,081	72,955	1,022,968
1924	6	85	64,785	1,172,403
1925	487	6,382	68,395	1,160,830
1926	608	6,555	90,293	1,438,765
1927	856	8,574	59,261	946,361
1928	762	6,264	62,481	966,183
1929	300	3,179	56,879	877,090
1930	842	8,687	45,328	691,236

Exports are not separately recorded.

MAGNESIUM

Domestic metallic magnesium (ingots, castings, alloys, ribbon, powder, rods, tubes, sheets, etc.) sold or used by producers in the United States, 1921–1927

Year	Pounds	Value	Year	Pounds	Value
1921	48, 000	$86, 000	1925	245, 000	$274, 400
1922	[1] 60, 000	[1] 89, 000	1926	322, 650	390, 400
1923	[1] 125, 000	[1] 155, 000	1927	366, 400	441, 700
1924	[1] 128, 000	[1] 150, 000			

[1] Estimate.

New ingot magnesium produced and sold in the United States, 1928–1930

Year	Produced (pounds)	Sold or used by producer	
		Pounds	Value
1928	521, 075	530, 782	$289, 658
1929	1, 329, 669	908, 351	512, 313
1930	1, 173, 557	559, 631	268, 864

Magnesium imported for consumption in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	39, 913	$30, 592	1926	10, 117	$4, 750
1922	182, 939	54, 448	1927	7, 131	8, 402
1923	13, 974	11, 576	1928	12, 039	11, 890
1924	8, 738	6, 561	1929	3, 490	6, 539
1925	8, 326	7, 070	1930	5, 689	19, 599

Exports are not separately recorded.

MANGANESE

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1921–1930

Year	Ore containing 35 per cent of manganese or more			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value
1921	14	13, 531	$495, 097	6	8, 439	$42, 755	3	62, 670	$147, 576
1922	18	13, 404	455, 160	9	344, 674	1, 071, 780	6	251, 614	632, 039
1923	36	31, 500	874, 973	41	319, 666	1, 158, 628	12	1, 072, 457	3, 598, 327
1924	39	56, 515	1, 307, 477	55	286, 470	929, 390	12	587, 026	1, 713, 943
1925	42	98, 324	1, 857, 769	53	267, 252	915, 316	11	1, 153, 268	2, 799, 403
1926	34	46, 258	1, 228, 663	54	364, 312	1, 179, 429	8	835, 412	1, 934, 381
1927	39	44, 741	1, 151, 918	47	148, 291	673, 921	9	1, 310, 127	3, 270, 460
1928	38	46, 860	1, 214, 853	31	90, 581	407, 289	8	1, 085, 401	2, 645, 165
1929	36	60, 379	1, 612, 357	32	78, 191	451, 843	8	1, 110, 067	2, 822, 623
1930	27	67, 035	1, 437, 465	27	77, 417	566, 155	6	707, 973	1, 835, 450

Manganese and manganiferous ore (for fluxing purposes) shipped from mines in the United States, 1921–1930[1]

Year	Ore containing 35 per cent of manganese or more		Ore containing 10 to 35 per cent of manganese		Ore containing 5 to 10 per cent of manganese	
	Long tons	Value	Long tons	Value	Long tons	Value
1921			22,962	[2] $57,000	3,028	[2] $7,800
1922	2,278	$17,341	27,705	[2] 52,000	1,666	[2] 10,600
1923	769	(3)	40,770	[2,3] 134,133	1,004	[2] 2,510
1924	1,833	(3)	24,972	[2,3] 107,215		
1925			25,384	[2] 36,177	2,150	[2] 1,590
1926			17,707	24,679		
1927			1,029	[4] 2,635	2,161	(4)
1928			48	[4] 853	1,602	(4)

[1] No shipments for fluxing purposes reported for 1929 and 1930.

[2] Partly estimated.

[3] Value for 35 per cent ore included with that for 10–35 per cent ore. Bureau of Mines not at liberty to publish figures.

[4] Value for 5–10 per cent ore included with that for 10–35 per cent ore. Bureau of Mines not at liberty to publish figures.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1929 and 1930, by States

State	Ore containing 35 per cent of manganese or more			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value
1929									
Alabama				3	475	$5,854			
Arizona	3	2,655	$27,826	1	45	181			
Arkansas	3	4,308	94,396	3	13,774	98,826			
California	4	569	8,099						
Colorado				2	17,770	(1)			
Georgia	2	2,521	(1)	7	5,310	57,432			
Idaho	3	1,326	13,707	1	38	239			
Michigan				1	11,023	43,541	2	38,089	(1)
Minnesota				1	5,421	24,991	5	1,004,420	$2,506,081
Montana:									
Metallurgical	3	29,945	(1)	1	15,665	(1)			
Chemical	[2] 2	12,382	(1)						
Nevada				5	2,407	21,462			
New Mexico	3	2,969	50,173				1	67,558	(1)
Tennessee	3	523	12,425	3	241	1,810			
Texas	1	42	(1)						
Utah	2	88	(1)	2	5,942	(1)			
Virginia:									
Metallurgical	[3] 7	2,651	52,577	2	80	810			
Chemical	[3] 1	400	(1)						
Undistributed			1,353,154			196,697			316,542
	[3] 36	60,379	1,612,357	32	78,191	451,843	8	1,110,067	2,822,623
1930									
Alabama				5	321	2,618			
Arizona	2	364	(1)	1	48	(1)			
Arkansas	4	3,276	58,172	3	12,645	96,964			
California	2	162	(1)						
Colorado				3	19,730	109,796			
Georgia	2	18,897	(1)	2	12,009	(1)			
Idaho				2	1,450	(1)			
Minnesota				1	4,698	17,837	5	693,546	1,794,334
Montana:									
Metallurgical	[3] 3	24,154	(1)	2	11,875	(1)			
Chemical	[2,3] 2	11,451	(1)						

[1] Included under "Undistributed."

[2] Figure represents mills through which all shipments were made; individual producers not counted.

[3] 1929: One producer in Virginia shipped both metallurgical and chemical ore. 1930: One producer each in Montana and Virginia shipped both metallurgical and chemical ore.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1929 and 1930, by States—Continued

State	Ore containing 35 per cent of manganese or more			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value	Number of shippers	Long tons	Value
1930—Continued									
Nevada	1	1,489	$17,617	2	3,363	(1)			
New Mexico	3	2,574	34,884				1	14,427	$41,116
North Carolina	1	60	(1)						
Tennessee	2	508	(1)	1	113	(1)			
Texas	2	247	4,147						
Utah				3	10,972	$91,742			
Virginia:									
Metallurgical	[3] 4	3,547	66,020	2	193	1,560			
Chemical	[3] 1	306	(1)						
Undistributed			1,256,625			245,638			
	[3] 27	67,035	1,437,465	27	77,417	566,155	6	707,973	1,835,450

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[1] Included under "Undistributed."

[3] 1929: 1 producer in Virginia shipped both metallurgical and chemical ore. 1930: 1 producer each in Montana and Virginia shipped both metallurgical and chemical ore.

Manganiferous iron ore shipped from the Cuyuna district, Minnesota, 1921–1930, in long tons

Year	Ore containing 10 to 35 per cent of manganese	Ore containing 5 to 10 per cent of manganese	Year	Ore containing 10 to 35 per cent of manganese	Ore containing 5 to 10 per cent of manganese
1921		56,530	1926	158,759	799,458
1922	305,093	248,560	1927	6,276	934,599
1923	253,634	499,181	1928	3,487	1,025,014
1924	159,915	361,527	1929	5,421	1,004,420
1925	77,665	741,409	1930	4,698	693,546

Manganese ore imported for consumption in the United States, 1921–1930

Year	Long tons		Value	Year	Long tons		Value
	Gross weight	Manganese content			Gross weight	Manganese content	
1921	401,354	(1)	$3,365,732	1926	(1)	[2] 297,630	$9,612,673
1922 Jan. 1–Sept. 21	327,727	(1)	2,695,724	1927	620,212	304,388	9,271,920
1922 Sept. 22–Dec. 31	(1)	[2] 18,124	364,247	1928	565,938	269,712	6,827,621
1923	(1)	[2] 78,391	1,674,914	1929	660,558	318,310	8,182,874
1924	(1)	[2] 224,230	5,305,791	1930	454,625	216,871	5,267,415
1925	(1)	[2] 277,055	7,417,582				

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[1] Not recorded by Bureau of Foreign and Domestic Commerce.

[2] Includes estimate by the Bureau of Mines for manganese content of ore imported from Cuba. The Bureau of Foreign and Domestic Commerce recorded only gross weight of Cuban ore imported, and the figures for such ore were as follows: 1922 (Sept. 22 to Dec. 31), 190 long tons; 1923, 9,062 tons; 1924, 23,065 tons; 1925, 12,745 tons; 1926, 14,112 tons.

No separate record of exports of manganese ore is kept.

MANGANIFEROUS ZINC RESIDUUM

Manganiferous residuum, from zinc roasting in the United States, shipped in 1921–1930, in long tons

1921	12, 627	1926	179, 926
1922	81, 333	1927	184, 771
1923	132, 801	1928	171, 107
1924	119, 457	1929	168, 363
1925	147, 937	1930	113, 060

MARLS

Calcareous marl sold by producers in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	59, 730	$195, 743	1926	55, 060	$146, 094
1922	67, 777	203, 196	1927	52, 962	180, 166
1923	99, 410	328, 932	1928	61, 034	200, 704
1924	72, 710	225, 383	1929	38, 990	130, 866
1925	68, 670	187, 839	1930	34, 012	112, 523

Greensand marl produced in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	2, 058	$10, 200	1926	12, 681	$174, 740
1922	7, 885	56, 800	1927	11, 911	168, 683
1923	10, 656	131, 123	1928	12, 988	207, 042
1924	14, 055	151, 205	1929	13, 266	255, 680
1925	12, 728	179, 788	1930	12, 761	221, 211

No imports or exports of marl are reported.

MERCURY

Mercury produced in the United States, 1921–1930

[Flasks of 76 pounds]

Year	Flasks	Value	Year	Flasks	Value
1921	6, 256	$300, 595	1926	7, 541	$702, 323
1922	6, 291	368, 348	1927	11, 128	1, 314, 782
1923	7, 833	521, 302	1928	17, 870	2, 207, 003
1924	9, 952	692, 739	1929	23, 682	2, 892, 638
1925	9, 053	762, 616	1930	21, 553	2, 478, 789

Mercury imported into and exported from the United States, 1921–1930

[Flasks of 76 pounds]

Year	Imports for consumption		Exports	
	Flasks	Value	Flasks	Value
1921	10, 462	$457, 993	388	$18, 869
1922	16, 697	757, 842	287	15, 910
1923	17, 836	816, 043	314	25, 195
1924	12, 996	566, 820	205	14, 333
1925	20, 580	1, 200, 878	201	15, 930
1926	25, 634	1, 784, 250	114	10, 319
1927	19, 941	1, 780, 134	(1)	(1)
1928	14, 562	1, 437, 153	(1)	(1)
1929	14, 917	1, 513, 197	(1)	(1)
1930	3, 725	361, 810	(1)	(1)

[1] Exports of mercury not separately recorded after 1926.

MICA

Mica sold by producers in the United States, 1921-1930

Year	Uncut sheet mica		Scrap mica		Total	
	Pounds	Value	Short tons	Value	Short tons	Value
1921	741,845	$118,513	2,577	$56,849	2,948	$175,362
1922	1,077,968	194,301	[1] 6,641	114,045	[1] 7,180	308,346
1923	2,063,179	311,180	[1] 8,054	129,695	[1] 9,086	440,875
1924	1,460,897	212,035	4,709	87,242	5,439	299,277
1925	1,793,865	321,962	9,695	173,537	10,592	495,499
1926	2,172,159	400,184	7,043	136,643	8,129	536,827
1927	1,512,492	212,482	6,280	110,139	7,036	322,621
1928	1,681,777	230,956	7,760	132,422	8,601	363,378
1929	2,035,128	286,321	6,253	117,901	7,271	404,222
1930	1,465,485	177,307	6,732	109,100	7,465	286,407

[1] Includes mica derived from mica schist.

Mica imported into and exported from the United States, 1921-1930

Year	Imports for consumption		Exports	
	Pounds	Value	Pounds	Value
1921	(1)	$1,091,906	(1)	$153,990
1922	(1)	1,330,622	1,134,397	129,186
1923	7,330,853	2,404,848	1,804,342	182,162
1924	5,801,151	2,326,906	1,519,636	169,741
1925	4,901,308	1,798,827	2,422,197	198,596
1926	6,318,096	2,450,834	2,326,131	230,511
1927	3,459,647	1,630,309	2,867,798	207,263
1928	4,104,975	1,426,495	3,661,587	229,391
1929	6,475,665	2,223,408	6,187,270	329,322
1930	6,958,145	1,283,616	4,732,864	262,826

[1] Quantity not reported.

MILLSTONES

[See Abrasive materials]

MINERAL PAINTS

Domestic zinc and lead pigments,[1] made in large part direct from ores in the United States, sold by producers, 1921-1930

Year	Short tons	Value	Year	Short tons	Value
1921	102,463	$14,801,032	1926	184,289	$25,896,269
1922	162,815	22,205,400	1927	191,853	25,275,975
1923	163,240	23,660,381	1928	202,363	26,017,743
1924	173,859	25,711,159	1929	204,574	26,211,556
1925	199,190	28,310,631	1930	147,948	18,420,436

[1] Include sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

The canvass of natural mineral pigments was discontinued after 1915. Figures covering iron ore sold for paint, 1921 to 1930, follow.

Iron ore sold for paint, by producers, in the United States, 1921-1930

Year	Short tons	Value	Year	Short tons	Value
1921	11,624	$56,824	1926	23,707	$129,541
1922	30,668	166,682	1927	25,023	132,007
1923	27,823	140,306	1928	17,815	83,190
1924	23,106	103,626	1929	15,754	90,352
1925	29,704	140,986	1930	10,832	53,520

MINERAL WATERS

Sales of natural mineral waters by producers in the United States, 1921 to 1923, were as follows: 1921, 34,781,238 gallons, valued at $4,876,445; 1922, 38,492,881 gallons, $5,498,269; 1923, 44,430,998 gallons, $6,493,177. Canvass discontinued after 1923.

Mineral waters (natural and artificial) imported for consumption in the United States, 1921–1930

Year	Gallons	Value	Year	Gallons	Value
1921	524,765	$167,101	1926	807,638	$360,221
1922	698,751	269,245	1927	1,000,038	500,757
1923	722,657	279,875	1928	804,502	396,006
1924	758,771	323,908	1929	1,031,835	510,911
1925	794,593	355,411	1930	919,989	477,158

Mineral waters (natural and artificial) exported from the United States, 1922–1930[1]

Year	Gallons	Value	Year	Gallons	Value
1922	209,219	$169,473	1927	197,978	$173,145
1923	227,831	193,248	1928	195,191	184,231
1924	221,203	179,418	1929	196,275	188,793
1925	206,754	178,828	1930	162,435	155,994
1926	255,860	191,798			

[1] Not separately recorded prior to 1922.

MOLYBDENUM

Molybdenum in ore and concentrates, produced in the United States, sold in 1921–1930[1]

Year	Pounds	Value	Year	Pounds	Value
1923	22,667	(2)	1927	2,286,075	$1,858,786
1924	297,174	(2)	1928	3,329,214	1,924,600
1925	1,154,050	[3] $961,324	1929	3,904,648	[3] 2,259,000
1926	1,431,830	1,192,714	1930	3,759,269	[3] 2,068,000

[1] No sales reported for 1921 and 1922.
[2] Value not reported.
[3] Estimate by Bureau of Mines.

"Molybdenum ore[1] (steel-hardening)" imported for consumption in the United States, 1921–1930[2]

Year	Pounds	Value	Year	Pounds	Value
1921	[3] 29,783	$20,471	1925	[4] 1,954	$1,793
1922	[3] 412,221	90,015	1926	[4] 13,397	11,175
1923	[4] 16,671	13,115	1927	[4] 12,541	10,472
1924	[4] 10,379	9,038			

[1] Prior to Sept. 22, 1922, imports recorded as ore; beginning with change in tariff, recorded as molybdenum content of ore.
[2] No imports reported for 1928, 1929, and 1930.
[3] Recorded as molybdenum ore.
[4] Recorded as molybdenum content of ore.

For imports of ferromolybdenum see Ferro-alloys.
Exports of ferromolybdenum are not separately classified.

MONAZITE

[See Thorium minerals]

NICKEL

Nickel content of nickel salts and metallic nickel produced in the United States as a by-product in the electrolytic refining of copper, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	111	$86,060	1926	323	$234,558
1922	208	133,191	1927	860	390,740
1923	100	71,605	1928	522	291,836
1924	191	114,903	1929	340	297,273
1925	272	169,664	1930	308	213,803

Secondary nickel recovered as metal and in nonferrous alloys and salts in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	945	$680,400	1926	3,050	$2,135,000
1922	1,512	967,700	1927	3,380	2,366,000
1923	1,550	1,109,800	1928	4,500	3,150,000
1924	2,240	1,227,500	1929	4,350	3,045,000
1925	2,300	1,518,000	1930	2,900	2,030,000

Value of nickel imported for consumption in the United States, 1921–1930

Year	Nickel, nickel ore and matte, nickel oxide, and alloys of nickel with copper, etc.	Manufactures and nickel sheets and strips	Total
1921	$1,220,347	$107,155	$1,327,502
1922	3,945,309	110,176	4,055,485
1923	6,602,096	94,832	6,696,928
1924	6,132,984	70,755	6,203,739
1925	7,772,320	98,761	7,871,081
1926	9,409,567	65,166	9,474,733
1927	8,802,075	111,816	8,913,891
1928	14,069,357	294,839	14,364,196
1929	19,098,105	318,154	19,416,259
1930	12,750,721	128,106	12,878,827

Nickel imported for consumption in the United States, 1929 and 1930, by classes

Class	1929		1930	
	Pounds	Value	Pounds	Value
Unmanufactured:				
Nickel ore and matte	28,981,343	$2,122,277	20,593,361	$2,940,074
Nickel alloys, pigs, bars, etc	64,561,241	16,480,998	38,323,029	9,600,404
Nickel oxide	3,265,425	494,633	1,353,096	209,420
Nickel silver or German silver	1,910	197	6,456	823
Manufactured:				
Nickel silver or German silver in sheets, strips, and rods	12,524	10,776	10,101	6,513
All other manufactures of nickel		307,378		121,593
		19,416,259		12,878,827

Nickel, nickel oxide, and matte exported from the United States, 1921 and 1922, as follows: 1921, 425,851 pounds, valued at $103,372; 1922, 9,317,520 pounds, $1,016,091. Nickel oxide and matte exported in 1923, 11,200 pounds, $626; separate figures for nickel not available. Similar exports not separately recorded after 1923.

Nickel exported from the United States, 1928–1930, by classes

Class	1928		1929		1930	
	Pounds	Value	Pounds	Value	Pounds	Value
Nickel Monel metal and other alloys	2, 349, 269	$879, 939	2, 869, 686	$1, 115, 568	2, 839, 446	$1, 207, 612
Manufactures	(1)	1, 160, 626	(1)	1, 347, 391	(1)	923, 547
Nickel silver or German silver in bars, rods, or sheets	1, 404, 549	364, 138	1, 044, 181	325, 992	1, 122, 050	243, 528
Nickel salts	(2)	(2)	42, 195	6, 400	815, 512	55, 277

[1] Quantity not recorded.

[2] Not separately recorded.

OILSTONES AND SCYTHESTONES

[See Abrasive materials]

ORE

Crude metallic ores (including old tailings, etc.) shipped from or treated at the mine in the United States, 1926–1930, in short tons

[Figures rounded]

Class of ore	1926	1927	1928	1929	1930
Aluminum ore (bauxite)	439, 000	359, 000	420, 000	410, 000	370, 000
Chromite	160	220	740	300	90
Dry and siliceous (gold and silver) ore	8, 743, 000	8, 550, 000	8, 095, 000	7, 671, 000	7, 767, 000
Iron ore [1]	77, 550, 000	68, 561, 000	71, 036, 000	84, 675, 000	61, 825, 000
Manganese ore (35 per cent or more Mn) [1]	52, 000	50, 000	52, 000	68, 000	75, 000
Manganiferous ore (5 to 35 per cent Mn) [1]	1, 344, 000	1, 633, 000	1, 317, 000	1, 331, 000	880, 000
Mercury ore	51, 000	(2)	(2)	(2)	(2)
Copper ore:					
Western States	49, 356, 000	48, 106, 000	53, 930, 000	59, 894, 000	39, 807, 000
Central States	7, 642, 000	8, 046, 000	7, 362, 000	7, 598, 000	6, 659, 000
Eastern States	638, 000	674, 000	833, 000	930, 000	916, 000
	57, 636, 000	56, 826, 000	62, 125, 000	68, 422, 000	47, 382, 000
Copper-lead and copper-lead-zinc ore	282, 000	419, 000	351, 000	259, 000	246, 000
Lead ore:					
Western States	2, 024, 000	2, 005, 000	1, 687, 000	1, 592, 000	1, 380, 000
Central States	6, 330, 000	6, 344, 000	6, 361, 000	6, 573, 000	6, 700, 000
Eastern States	4, 000				
	8, 358, 000	8, 349, 000	8, 048, 000	8, 165, 000	8, 080, 000
Lead-zinc ore:					
Western States	3, 461, 000	3, 135, 000	3, 583, 000	3, 497, 000	2, 605, 000
Central States	15, 488, 000	11, 310, 000	9, 796, 000	10, 972, 000	7, 327, 000
Eastern States	144, 000	202, 000			713, 000
	19, 093, 000	14, 647, 000	13, 379, 000	14, 469, 000	10, 645, 000
Zinc ore:					
Western States	215, 000	452, 000	161, 000	494, 000	249, 000
Central States	2, 806, 000	5, 177, 000	4, 350, 000	5, 076, 000	4, 200, 000
Eastern States	1, 118, 000	1, 194, 000	1, 344, 000	1, 623, 000	1, 531, 000
	4, 139, 000	6, 823, 000	5, 855, 000	7, 193, 000	5, 980, 000
Grand total	177, 687, 000	166, 217, 000	170, 679, 000	192, 663, 000	143,250,000

[1] Exclusive of fluxing ore.

[2] Figures not available.

PEAT

Peat produced in the United States, 1921–1926 [1]

Year	Short tons	Value	Year	Short tons	Value
1921	30, 406	$260, 119	1924	55, 469	$395, 470
1922	60, 680	397, 729	1925	72, 436	452, 898
1923	61, 355	376, 834	1926	61, 936	364, 413

[1] No canvass after 1926.

Peat moss imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	3, 450	$22, 754	1926	16, 669	$174, 241
1922	4, 805	33, 034	1927	31, 595	326, 549
1923	5, 973	43, 184	1928	40, 087	422, 275
1924	5, 541	47, 208	1929	57, 531	657, 145
1925	10, 233	121, 719	1930	70, 466	809, 381

PETROLEUM AND PETROLEUM PRODUCTS

CRUDE PETROLEUM

Crude petroleum produced in the United States, 1921–1930

[Barrels of 42 U. S. gallons]

Year	Barrels	Value at wells	Year	Barrels	Value at wells
1921	472, 183, 000	$814, 745, 000	1926	770, 874, 000	$1, 447, 760, 000
1922	557, 531, 000	895, 111, 000	1927	901, 129, 000	1, 172, 830, 000
1923	732, 407, 000	978, 430, 000	1928	901, 474, 000	1, 054, 880, 000
1924	713, 940, 000	1, 022, 683, 000	1929	1, 007, 323, 000	1, 280, 417, 000
1925	763, 743, 000	1, 284, 960, 000	1930	898, 011, 000	1, 070, 200, 000

Crude petroleum produced in the United States, 1929 and 1930, by fields and States

	1929		1930	
	Barrels	Value at wells	Barrels	Value at wells
FIELD				
Appalachian	33, 824, 000	$104, 490, 000	34, 105, 000	$76, 206, 000
Lima-Indiana	1, 547, 000	2, 660, 000	1, 365, 000	2, 010, 000
Illinois and southwestern Indiana	7, 237, 000	11, 950, 000	6, 677, 000	10, 640, 000
Michigan	4, 528, 000	6, 140, 000	3, 911, 000	5, 160, 000
Mid-Continent	583, 058, 000	728, 190, 000	531, 447, 000	601, 470, 000
Gulf coast	57, 106, 000	69, 080, 000	69, 676, 000	72, 850, 000
Rocky Mountain [1]	27, 489, 000	36, 540, 000	23, 501, 000	30, 165, 000
California	292, 534, 000	321, 367, 000	227, 329, 000	271, 699, 000
Other fields [2]	(1)	(1)	(1)	(1)
	1, 007, 323, 000	1, 280, 417, 000	898, 011, 000	1, 070, 200, 000
STATE				
Alaska	[3] 7, 000	[3] 30, 000	[3] 7, 000	[3] 15, 000
Arkansas	24, 917, 000	21, 890, 000	19, 702, 000	17, 390, 000
California	292, 534, 000	321, 367, 000	227, 329, 000	271, 699, 000
Colorado	2, 358, 000	2, 380, 000	1, 652, 000	1, 480, 000
Illinois	6, 319, 000	10, 430, 000	5, 730, 000	9, 100, 000
Indiana	981, 000	1, 610, 000	994, 000	1, 610, 000
Kansas	42, 813, 000	62, 510, 000	41, 648, 000	54, 880, 000
Kentucky	7, 775, 000	13, 220, 000	7, 389, 000	11, 080, 000
Louisiana	20, 554, 000	25, 700, 000	23, 272, 000	26, 110, 000
Michigan	4, 528, 000	6, 140, 000	3, 911, 000	5, 160, 000
Montana	3, 980, 000	7, 260, 000	3, 349, 000	5, 420, 000
New Mexico	1, 830, 000	2, 170, 000	10, 189, 000	9, 180, 000
New York	3, 377, 000	13, 170, 000	3, 647, 000	9, 850, 000
Ohio	6, 743, 000	15, 770, 000	6, 486, 000	11, 960, 000
Oklahoma	255, 004, 000	364, 650, 000	216, 486, 000	279, 250, 000
Pennsylvania	11, 820, 000	44, 800, 000	12, 803, 000	33, 410, 000
Tennessee	19, 000	30, 000	21, 000	26, 000
Texas	296, 876, 000	322, 520, 000	290, 457, 000	288, 410, 000
Utah	(3)	(3)	(3)	(3)
West Virginia	5, 574, 000	20, 070, 000	5, 071, 000	11, 820, 000
Wyoming	19, 314, 000	24, 700, 000	17, 868, 000	22, 350, 000
	1, 007, 323, 000	1, 280, 417, 000	898, 011, 000	1, 070, 200, 000

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[1] Production of Alaska included with Rocky Mountain.

[2] Alaska.

[3] Utah included with Alaska.

Crude petroleum imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports			
			Domestic petroleum		Foreign petroleum [1]	
	Barrels	Value	Barrels	Value	Barrels	Value
1921	125, 363, 983	$66, 547, 379	8, 865, 497	$20, 204, 491	74, 136	$57, 407
1922	127, 308, 423	70, 383, 309	9, 995, 093	18, 348, 110	167, 724	74, 121
1923	82, 015, 025	53, 882, 259	17, 060, 771	23, 111, 832	324, 607	150, 358
1924	77, 775, 173	73, 841, 507	17, 604, 877	26, 495, 011	367, 662	165, 401
1925	61, 824, 242	75, 406, 956	13, 125, 157	24, 274, 905	209, 950	94, 372
1926	60, 382, 329	79, 307, 877	15, 406, 045	28, 495, 773	1, 353	4, 436
1927	58, 382, 632	78, 609, 117	15, 843, 405	25, 944, 489	241	333
1928	79, 766, 672	90, 472, 376	18, 961, 362	26, 786, 248	995	1, 618
1929	78, 932, 572	79, 943, 429	26, 394, 349	37, 799, 683	9	23
1930	62, 129, 419	64, 872, 121	23, 704, 162	32, 153, 377	----------	----------

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[1] Exports of refined products and shipments of crude petroleum to Alaska, Hawaii, Porto Rico, and the Philippine Islands are not included.

PETROLEUM PRODUCTS

Crude petroleum run to stills and chief petroleum products produced at refineries in the United States, 1921–1930, in barrels

Year	Crude petroleum run to stills		Chief petroleum products			
	Domestic	Foreign	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1921	443, 363, 000		122, 704, 000	46, 313, 000	230, 091, 000	20, 896, 000
1922	425, 823, 000	74, 883, 000	147, 672, 000	54, 913, 000	254, 910, 000	23, 304, 000
1923	538, 252, 000	42, 986, 000	179, 903, 000	55, 927, 000	287, 481, 000	26, 128, 000
1924	597, 954, 000	45, 765, 000	213, 326, 000	60, 026, 000	320, 476, 000	27, 498, 000
1925	698, 582, 000	41, 338, 000	259, 601, 000	59, 689, 000	364, 991, 000	31, 055, 000
1926	734, 301, 000	44, 963, 000	299, 734, 000	61, 768, 000	365, 195, 000	32, 293, 000
1927	778, 729, 000	50, 106, 000	330, 435, 000	56, 113, 000	393, 066, 000	31, 721, 000
1928	835, 711, 000	77, 584, 000	376, 945, 000	59, 353, 000	427, 237, 000	34, 658, 000
1929	912, 191, 000	75, 517, 000	435, 078, 000	55, 940, 000	448, 949, 000	34, 359, 000
1930	866, 615, 000	60, 832, 000	432, 241, 000	49, 208, 000	372, 498, 000	34, 201, 000

Chief petroleum products imported for consumption in the United States, 1921–1930, in barrels

Year	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1921	900, 381	(1)	(1)	(1)
1922	1, 479, 349	[2] 3, 487	[2] 2, 947, 102	[2] 43, 057
1923	4, 555, 084	7, 178	12, 286, 260	29, 027
1924	3, 452, 923	9, 942	12, 926, 837	10, 761
1925	3, 812, 790	19, 281	12, 245, 468	37, 475
1926	5, 539, 585	74, 097	14, 432, 175	33, 018
1927	5, 002, 306	55, 435	8, 124, 192	7, 944
1928	4, 197, 708	201, 745	7, 268, 147	12, 654
1929	8, 835, 502	208, 008	20, 545, 498	39, 355
1930	16, 926, 800	200, 086	26, 080, 383	24, 720

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[1] Not separately recorded prior to Sept. 22, 1922.
[2] Figures cover Sept. 22 to Dec. 31, 1922; not separately recorded prior to change in tariff.

Chief petroleum products exported from the United States, 1921–1930, in barrels

Year	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants
1921	12, 692, 270	17, 832, 693	20, 120, 493	6, 888, 491
1922	13, 787, 191	21, 315, 015	16, 600, 462	7, 889, 516
1923	20, 135, 567	20, 188, 796	29, 252, 245	8, 295, 726
1924	28, 216, 078	21, 817, 890	34, 292, 709	9, 030, 944
1925	30, 637, 804	21, 074, 667	32, 508, 547	9, 596, 484
1926	42, 479, 876	22, 016, 214	34, 516, 390	9, 265, 781
1927	43, 334, 164	19, 352, 102	42, 963, 180	9, 686, 361
1928	51, 751, 754	21, 846, 633	41, 573, 185	10, 933, 160
1929	60, 006, 674	19, 820, 352	35, 714, 784	10, 775, 060
1930	63, 195, 331	16, 689, 684	32, 377, 758	9, 849, 297

PHOSPHATE ROCK

Phosphate rock sold or used by producers in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	2, 064, 025	$12, 270, 070	1926	3, 209, 976	$10, 893, 800
1922	2, 417, 883	10, 482, 846	1927	3, 170, 699	11, 253, 352
1923	3, 006, 706	11, 576, 049	1928	3, 501, 406	12, 443, 179
1924	2, 867, 789	10, 252, 083	1929	3, 760, 855	13, 153, 259
1925	3, 481, 819	11, 545, 678	1930	3, 926, 392	13, 996, 830

Phosphate rock imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value
1921	3, 535	$43, 960	733, 312	$7, 320, 137
1922	5, 890	95, 846	719, 294	5, 858, 167
1923	6, 725	92, 263	827, 551	5, 772, 171
1924	16, 098	181, 515	818, 773	5, 120, 832
1925	2, 735	37, 932	870, 200	5, 677, 763
1926	17, 378	192, 611	748, 963	4, 435, 590
1927	28, 195	292, 871	918, 211	4, 731, 562
1928	45, 812	431, 238	898, 764	4, 453, 101
1929	44, 899	469, 171	1, 142, 746	5, 386, 919
1930	32, 658	377, 177	1, 225, 722	5, 630, 547

PLATINUM AND ALLIED METALS

Reports received from refiners of crude platinum, gold bullion, and copper indicate that 43,502 troy ounces of refined new metals of the platinum group were recovered in 1930, of which 9,308 ounces are believed to be of domestic origin.

New platinum and allied metals recovered by refiners in the United States, 1921–1930, in troy ounces

Year	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1921	51, 791	2, 686	286	581	1, 026	56, 370
1922	54, 142	1, 943	210	1, 301	122	57, 718
1923	46, 780	1, 934	280	787	16	49, 797
1924	57, 827	6, 065	680	1, 261	174	66, 007
1925	41, 300	7, 358	283	648	54	49, 643
1926	76, 154	6, 437	234	2, 113	43	84, 981
1927	41, 121	3, 879	256	631	163	46, 050
1928	51, 427	5, 148	1, 658	458	348	59, 039
1929	41, 760	5, 295	302	364	256	47, 977
1930	37, 780	3, 801	1, 468	334	119	43, 502

Dealers and refiners reported recovery in 1930 of 47,316 ounces of secondary platinum metals derived from refining scrap metal, sweeps, and other waste products of manufacture that contain platinum.

Secondary platinum and allied metals recovered in the United States, 1921–1930, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1921	39, 131	4, 887	1, 776	229	46, 023
1922	40, 062	4, 193	1, 937	496	46, 688
1923	39, 152	6, 246	2, 021	453	47, 872
1924	45, 474	5, 784	2, 200	1, 013	54, 471
1925	35, 578	4, 680	1, 827	1, 189	43, 274
1926	38, 795	5, 647	1, 478	217	46, 137
1927	46, 127	4, 244	1, 810	891	53, 072
1928	47, 157	4, 156	2, 090	2, 428	55, 831
1929	33, 638	5, 120	2, 057	1, 944	42, 759
1930	33, 787	7, 426	4, 354	1, 749	47, 316

Platinum and allied metals imported for consumption in the United States, 1921–1930

Year	Troy ounces	Value	Year	Troy ounces	Value
1921	78, 378	$5, 418, 464	1926	134, 797	$13, 451, 835
1922	110, 025	8, 983, 547	1927	148, 769	12, 413, 494
1923	106, 637	10, 466, 705	1928	135, 233	9, 357, 737
1924	111, 359	11, 030, 349	1929	155, 075	9, 119, 479
1925	125, 802	13, 230, 148	1930	139, 246	5, 836, 492

Platinum and allied metals imported for consumption in the United States, 1929 and 1930, by metals

Metal	1929		1930	
	Troy ounces	Value	Troy ounces	Value
Platinum:				
Ores of platinum metals (platinum content)	564	$43, 152		
Grains, nuggets, sponge, or scrap	74, 063	4, 466, 149	81, 229	$3, 363, 858
Ingots, bars, sheets or plates, not less than one-eighth inch thick	40, 594	2, 640, 097	24, 926	961, 334
	115, 221	7, 149, 398	106, 155	4, 325, 192
Manufactures of, except jewelry	2	697	25	520
Iridium	4, 470	887, 893	4, 196	665, 475
Osmiridium	6, 863	391, 025	5, 654	319, 292
Osmium	1, 124	70, 515	1, 100	65, 642
Palladium	24, 364	532, 285	18, 506	353, 772
Rhodium	2, 073	61, 849	2, 291	69, 717
Ruthenium	958	25, 817	1, 319	36, 882
	155, 075	9, 119, 479	139, 246	5, 836, 492

Platinum exported from the United States, 1921–1930

Year	Unmanufactured		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1921	3,272	$244,473	741	$85,216
1922 Crude, scrap, and old	143	13,149	486	35,967
1922 Ingots, sheets, wire, and alloys	1,313	127,047		
1923	1,151	128,509	592	65,073
1924	5,874	643,282	1,274	136,948
1925	16,234	1,787,122	3,337	249,975
1926	11,573	1,253,795	1,898	160,648
1927	19,923	1,577,300	1,549	128,875
1928	9,050	619,478	2,168	160,554
1929	2,567	193,122	1,456	112,252
1930	1,037	62,072	769	40,850

POTASH

Crude potassium salts produced and sold in the United States, 1921–1930

Year	Produced			Sold		
	Number of plants	Gross weight (short tons)	Equivalent as K_2O (short tons)	Gross weight (short tons)	Equivalent as K_2O (short tons)	Value f. o. b. plant
1921	20	25,485	10,171	10,337	4,408	$447,859
1922	12	25,176	11,714	22,028	11,313	463,512
1923	12	39,029	20,215	35,164	19,281	784,671
1924	12	43,734	22,903	37,492	21,880	842,618
1925	9	51,565	25,448	52,823	25,802	1,204,024
1926	7	46,324	23,366	51,369	25,060	1,083,064
1927	9	76,819	43,510	94,722	49,500	2,448,146
1928	9	104,129	59,910	105,208	60,370	3,029,422
1929	5	107,820	61,590	101,370	57,540	2,988,448
1930	5	105,810	61,270	98,280	56,610	2,986,157

Potash materials imported for consumption in the United States, 1921–1930

Year	Potassium salts used mainly in the fertilizer industry [1]			Potassium salts used mainly in chemical industries [2]			Total		
	Short tons		Value	Short tons		Value	Short tons		Value
	Gross weight	Equivalent as K_2O (approximate)		Gross weight	Equivalent as K_2O (approximate)		Gross weight	Equivalent as K_2O (approximate)	
1921	212,752	64,126	$7,743,364	32,453	14,572	$3,739,090	245,205	78,698	$11,482,454
1922	632,711	186,264	10,951,197	34,198	15,151	4,415,891	666,909	201,415	15,367,088
1923	712,701	194,210	10,633,475	35,824	15,740	4,771,097	748,525	209,950	15,404,572
1924	663,914	187,079	10,042,575	28,336	13,286	3,325,552	692,250	200,365	13,368,127
1925	892,684	239,167	12,730,019	44,429	19,050	4,641,747	937,113	258,217	17,371,766
1926	859,422	245,700	13,635,154	47,941	20,580	4,796,711	907,363	266,280	18,431,865
1927	687,349	225,000	13,178,610	43,248	19,155	5,191,195	730,597	244,155	18,369,805
1928	931,616	310,000	18,227,830	44,045	20,493	4,292,162	975,661	330,493	22,519,992
1929	870,502	297,000	17,629,535	58,968	27,638	6,043,106	929,470	324,638	23,672,641
1930	933,324	322,000	19,905,069	45,682	20,084	4,589,457	979,006	342,084	24,494,526

[1] Includes kainite, manure salts, muriate, and sulphate. Considerable quantities of muriate and some sulphate were used in chemical industries.

[2] Includes bicarbonate, bichromate, bitartrate, bromide, carbonate, caustic, chlorate, chromate, cyanide, ferricyanide, ferrocyanide, iodide, nitrate, perchlorate, permanganate, and Rochelle salt.

Domestic potassium salts exported from the United States, 1921–1930

Year	Gross weight (short tons)	Value	Year	Gross weight (short tons)	Value
1921	(1)	$335,993	1926	1,679	$319,201
1922	6,238	780,996	1927	1,965	487,726
1923	3,997	505,837	1928	2,619	609,018
1924	1,923	301,036	1929	1,523	583,668
1925	2,155	398,740	1930	1,256	498,774

(1) Figures not available.

PUMICE

[See Abrasive materials]

PYRITES

Pyrites [1] produced in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	157,118	$711,432	1926	166,559	$616,668
1922	169,043	671,241	1927	215,786	804,006
1923	181,628	661,000	1928	312,815	1,081,758
1924	160,096	645,262	1929	333,465	1,250,141
1925	170,081	650,448	1930	347,512	1,028,680

[1] Figures for 1928, 1929, and 1930 include by-product pyrites from zinc operations in Wisconsin and New York and pyrite and pyrrhotite concentrates from copper operations in Tennessee. Similar output for Wisconsin and Tennessee in earlier years (1922 to 1927) not included in the statistics. The production of pyrite and pyrrhotite concentrates in Tennessee began in 1925.

Pyrites containing more than 25 per cent of sulphur imported for consumption in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	216,229	$818,852	1926	366,151	$856,981
1922	279,445	1,199,076	1927	250,794	647,512
1923	263,695	1,254,389	1928	457,123	1,135,463
1924	246,737	598,544	1929	514,336	1,507,648
1925	276,385	773,925	1930	354,543	1,009,081

Exports of "pyrites or other sulphur ore" in 1922 amounted to 323 long tons, valued at $4,325. Data for other years are not separately shown by the Bureau of Foreign and Domestic Commerce.

QUARTZ

[See Silica]

QUICKSILVER

[See Mercury]

RADIUM

[See Uranium and vanadium ores]

RUTILE

[See Titanium minerals]

SALT

Salt sold or used by producers in the United States, 1921–1930

Year	Short tons				Total value
	Manufactured (evaporated)	In brine	Rock salt	Total	
1921	1,931,243	1,577,335	1,472,576	4,981,154	$24,557,966
1922	2,276,683	2,569,042	1,947,124	6,792,849	27,464,838
1923	2,239,872	2,787,239	2,103,602	7,130,713	27,795,941
1924	2,224,555	2,513,853	2,064,707	6,803,115	25,747,048
1925	2,235,170	2,819,690	2,342,640	7,397,500	26,162,361
1926	2,198,060	3,037,820	2,135,720	7,371,600	25,055,012
1927	2,263,030	3,161,800	2,143,860	7,568,690	24,817,962
1928	2,430,050	3,426,870	2,217,780	8,074,700	26,772,568
1929	2,546,390	3,884,160	2,113,010	8,543,560	27,334,695
1930	2,358,610	3,718,460	1,977,370	8,054,440	25,009,480

Salt sold or used by producers in the United States, 1929 and 1930, by States

State	1929		1930	
	Short tons	Value	Short tons	Value
California	410,300	$2,432,329	350,370	$2,080,133
Kansas	840,370	3,761,984	759,800	3,148,728
Louisiana	525,840	2,277,366	535,250	2,164,365
Michigan	2,650,220	8,343,607	2,558,290	7,884,072
New York	2,194,590	6,470,051	2,009,280	5,837,103
Ohio	1,449,360	3,199,903	1,311,440	3,015,206
Utah	84,940	202,676	85,240	188,983
West Virginia	20,290	153,477	28,670	184,327
Undistributed [1]	367,650	493,302	416,100	506,563
	8,543,560	27,334,695	8,054,440	25,009,480

[1] Nevada, New Mexico, Oklahoma, Porto Rico, Texas, and Virginia.

Salt imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1921	93,095	$531,031	109,563	$1,415,471
1922	113,922	522,338	134,989	1,429,172
1923	88,750	383,258	125,529	1,211,226
1924	88,938	324,092	144,945	1,288,376
1925	85,788	316,827	155,079	1,219,935
1926	55,964	202,243	158,908	1,277,790
1927	44,968	167,675	153,832	1,329,980
1928	42,856	149,559	145,396	1,185,682
1929	36,450	131,716	109,222	1,008,842
1930	54,021	143,953	70,478	715,575

SAND AND GRAVEL

Sand and gravel sold or used by producers in the United States, 1921–1930

Year	Glass sand		Molding sand		Building sand	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	1, 280, 359	$2, 314, 314	1, 906, 977	$2, 451, 966	24, 565, 605	$16, 053, 413
1922	1, 768, 549	2, 866, 366	3, 839, 116	4, 478, 405	29, 375, 466	17, 574, 579
1923	2, 034, 958	3, 751, 778	5, 559, 644	6, 730, 417	39, 234, 762	23, 751, 244
1924	2, 169, 899	3, 718, 973	4, 403, 893	4, 995, 268	41, 376, 425	23, 455, 393
1925	2, 334, 921	3, 836, 085	4, 995, 428	5, 400, 618	45, 287, 240	26, 306, 463
1926	2, 274, 218	3, 615, 371	5, 309, 166	5, 630, 799	45, 327, 512	24, 891, 475
1927	2, 171, 693	3, 257, 790	4, 194, 975	4, 458, 508	40, 737, 377	22, 198, 767
1928	2, 310, 828	3, 435, 645	4, 781, 765	5, 089, 969	45, 629, 207	24, 116, 772
1929	2, 219, 677	3. 788, 471	6, 195, 343	6, 410, 343	41, 161, 013	23, 309, 238
1930	1, 849, 101	3, 210, 973	3, 336, 855	3, 547, 154	33, 599, 524	18, 850, 936

Year	Other sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	10, 542, 013	$8, 230, 257	41, 550, 054	$27, 434, 295	79, 845, 008	$56, 484, 245
1922	14, 711, 792	10, 550, 570	45, 172, 123	29, 147, 744	94, 867, 046	64, 617, 664
1923	20, 535, 907	14, 240, 126	72, 566, 882	42, 430, 089	139, 932, 153	90, 903, 654
1924	27, 621, 793	16, 674, 831	80, 658, 053	48, 168, 650	156, 230, 063	97, 013, 115
1925	34, 564, 633	19, 605, 159	84, 819, 251	52, 393, 798	172, 001, 473	107, 542, 123
1926	39, 203, 383	21, 538, 343	90, 986, 539	55, 662, 713	183, 100, 818	111, 338, 701
1927	46, 484, 294	24, 376, 333	103, 865, 930	61, 238, 388	197, 454, 269	115, 529, 786
1928	45, 015, 917	23, 490, 020	111, 381, 151	63, 075, 531	209, 118, 868	119, 207, 937
1929	49, 677, 021	27, 293, 305	123, 318, 851	72, 034, 622	222, 571, 905	132, 835, 979
1930	44, 873, 138	24, 112, 490	113, 393, 108	65, 454, 990	197, 051, 726	115, 176, 543

Sand and gravel imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Short tons	Value	Short tons	Value
1921	906, 905	$771, 734	(1)	$379, 982
1922	451, 943	238, 386	356, 520	400, 199
1923	477, 762	259, 820	551, 233	598, 633
1924	701, 410	280, 206	314, 140	401, 662
1925	534, 555	233, 422	425, 612	496, 050
1926	947, 579	341, 911	424, 374	610, 023
1927	736, 271	302, 551	421, 243	557, 644
1928	788, 222	392, 111	737, 368	638, 288
1929	1, 666, 387	751, 602	486, 378	809, 831
1930	1, 832, 850	719, 345	323, 090	570, 107

[1] Quantity not recorded prior to 1922.

SAND-LIME BRICK

Sand-lime brick produced in the United States, 1921–1930[1]

Year	Number of operators	Thousands	Value	Year	Number of operators	Thousands	Value
1921	26	97, 126	$1, 268, 502	1926	42	330, 586	$3, 981, 492
1922	(2)	(2)	(2)	1927	47	319, 618	3, 645, 842
1923	33	213, 425	2, 471, 536	1928	41	313, 553	3, 654, 590
1924	37	283, 417	3, 334, 503	1929	40	269, 584	2, 909, 635
1925	42	315, 595	3, 780, 639	1930	37	191, 193	1, 950, 709

[1] According to Bureau of the Census.

[2] No canvass.

Sand-lime brick imported for consumption in the United States, 1924–1930 [1]

Year	Thousands	Value	Year	Thousands	Value
1924	22, 426	$129, 042	1928	1, 707	$8, 628
1925	148	1, 004	1929	675	6, 583
1926	3, 095	28, 748	1930	3	39

[1] Not separately recorded prior to 1924. No imports reported for 1927.

Exports are not separately recorded.

SELENIUM

Most of the selenium produced is a by-product in the electrolytic refining of copper.

Selenium, produced in the United States, sold in 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	55, 978	$89, 148	1926	252, 312	$438, 132
1922	123, 565	177, 542	1927	284, 508	491, 996
1923	127, 174	237, 196	1928	362, 697	607, 382
1924	153, 762	286, 066	1929	344, 288	568, 265
1925	194, 007	330, 637	1930	278, 309	454, 911

Selenium and selenium salts imported for consumption in the United States 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	1, 106	$2, 099	1926	18, 885	$34, 680
1922	1, 652	2, 530	1927	15, 286	28, 199
1923	940	1, 653	1928	18, 622	33, 998
1924	300	606	1929	3, 592	5, 971
1925	5, 807	10, 582	1930	680	988

Exports of selenium are not separately recorded.

SILICA

Quartz sold or used by producers in the United States, 1921–1930

Year	Crude		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	8, 570	$39, 660	2, 682	$45, 297	11, 252	$84, 957
1922	5, 085	23, 093	5, 568	78, 254	10, 653	101, 347
1923	14, 159	66, 723	6, 442	126, 907	20, 601	193, 630
1924	20, 570	123, 099	3, 191	80, 078	23, 761	203, 177
1925	22, 312	143, 861	3, 132	61, 515	25, 444	205, 376
1926	22, 230	159, 052	5, 513	115, 281	27, 743	274, 333
1927	18, 504	124, 021	3, 640	70, 019	22, 144	194, 040
1928	15, 363	79, 229	6, 835	130, 104	22, 198	209, 333
1929	13, 104	59, 257	7, 877	146, 502	20, 981	205, 759
1930	7, 362	32, 531	5, 794	88, 758	13, 156	121, 289

Silica sold or used by producers in the United States for pottery, paints, fillers, polishers, abrasives, and other uses, 1929 and 1930

Material	1929		1930	
	Short tons	Value	Short tons	Value
Quartz (vein quartz, pegmatite, and quartzite)	20,981	$205,759	13,156	$121,289
Sand and sandstone [1]	302,139	2,039,144	241,947	1,566,815
Tripoli (including rottenstone) (ground and otherwise prepared)	38,011	545,658	32,439	507,505
Diatomite	(2)	(2)	(2)	(2)
	(2)	(2)	(2)	(2)

[1] Includes only finely ground material. Figures probably incomplete.
[2] Bureau of Mines not at liberty to publish figures for diatomite.

Imports of "crude silica" have been as follows: 1930, 1929, and 1928, none; 1927, 12 short tons, valued at $175; 1926, 27 tons, $149; 1925, 22 tons, $486; 1924, 12 tons, $254; and 1923, 34 tons, $550. Similar imports were not recorded prior to September 22, 1922, but from that date to the end of the year 1 ton, valued at $45, was imported. Imports of "silica for use as pigment" have been recorded as follows: 1930, 1929, and 1928, none; 1927, 22 short tons, valued at $535; similar imports not separately recorded for earlier years. The Bureau of Foreign and Domestic Commerce records imports of "flint, flints, and flint stones, unground," from several countries. These imports are partly flint pebbles for use in grinding mills and partly material for uses such as are listed above. The figures can not be accurately separated.

"Flint, flints, and flint stones, unground" imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	10,084	$116,157	1926	15,091	$120,078
1922	16,040	145,805	1927	15,191	93,658
1923	15,952	130,974	1928	15,719	144,313
1924	17,473	114,958	1929	14,097	127,457
1925	16,240	105,041	1930	6,856	62,463

No exports of silica are reported.

SILVER

[See Gold and silver]

SLATE

Slate sold by producers in the United States, 1921–1930, by uses

Year	Roofing slate		Mill stock		Slate for other uses [1]	Total value
	Number of squares (100 square feet)	Value	Square feet	Value		
1921	348, 085	$3, 197, 745	8, 970, 000	$2, 719, 723	$1, 404, 538	$7, 322, 006
1922	479, 243	4, 069, 761	9, 276, 800	2, 899, 195	2, 207, 828	9, 176, 784
1923	507, 587	4, 582, 535	11, 109, 480	4, 159, 644	3, 334, 445	12, 076, 624
1924	499, 393	4, 626, 614	10, 009, 180	3, 922, 366	3, 227, 036	11, 776, 016
1925	494, 530	5, 084, 945	11, 077, 860	4, 231, 477	3, 258, 904	12, 575, 326
1926	465, 900	5, 079, 087	10, 278, 130	4, 191, 185	3, 082, 495	12, 352, 767
1927	468, 560	4, 949, 940	9, 287, 680	3, 519, 386	2, 911, 410	11, 380, 736
1928	483, 280	5, 411, 332	9, 220, 170	3, 408, 304	2, 652, 655	11, 472, 291
1929	462, 120	4, 920, 766	9, 936, 480	3, 702, 145	2, 622, 267	11, 245, 178
1930	340, 140	3, 359, 939	7, 917, 220	2, 755, 530	1, 796, 149	7, 911, 618

[1] Chiefly slate granules.

Value of slate sold by producers in the United States, 1926–1930, by States

State	1926	1927	1928	1929	1930
California	$2, 976	(1)	(1)	(1)	$41, 377
Maine	662, 184	$549, 952	$551, 242	$653, 627	506, 322
Maryland	207, 989	205, 812	187, 830	214, 770	(1)
New York	913, 814	802, 437	1, 052, 363	838, 531	438, 619
Pennsylvania	5, 413, 177	4, 769, 432	4, 786, 355	4, 798, 200	3, 634, 258
Vermont	4, 267, 041	4, 108, 911	3, 981, 928	3, 704, 894	2, 463, 241
Virginia	[2] 331, 651	[2] 398, 612	[2] 458, 153	[2] 434, 628	[2] 303, 335
Undistributed [3]	[4] 553, 935	[4] 545, 580	[4] 454, 420	[4] 600, 528	[4] 524, 466
	12, 352, 767	11, 380, 736	11, 472, 291	11, 245, 178	7, 911, 618

[1] Included under "Undistributed."
[2] Exclusive of value of granules, etc., which is included under "Undistributed."
[3] 1926: Arkansas, Georgia, and Tennessee; 1927: California, Georgia, and Tennessee; 1928: Arkansas, California, Georgia, and Tennessee; 1929: Arkansas, California, Georgia, and New Jersey; 1930: Arkansas, Georgia, Maryland, and New Jersey.
[4] Includes also value of granules, etc., for Virginia.

Slate sold by producers in the United States, 1929 and 1930, by uses

Use	1929		1930	
	Quantity	Value	Quantity	Value
Roofing ... squares	462, 120	$4, 920, 766	340, 140	$3, 359, 939
Approximate equivalent in short tons	178, 500		127, 080	
Electrical ... square feet	1, 461, 110	1, 153, 396	928, 760	711, 578
Approximate equivalent in short tons	12, 580		7, 690	
Structural and sanitary ... square feet	3, 286, 550	1, 287, 150	2, 498, 340	960, 190
Approximate equivalent in short tons	24, 730		19, 190	
Grave vaults and covers ... square feet	515, 450	133, 031	350, 440	85, 047
Approximate equivalent in short tons	4, 700		3, 290	
Blackboards and bulletin boards ... square feet	3, 562, 360	1, 042, 771	3, 092, 880	921, 735
Approximate equivalent in short tons	9, 280		7, 830	
Billiard-table tops ... square feet	161, 470	65, 426	143, 440	57, 750
Approximate equivalent in short tons	1, 390		1, 270	
School slates ... pieces	1, 843, 000	20, 371	1, 688, 540	19, 230
Approximate equivalent in square feet	949, 540		903, 360	
Approximate equivalent in short tons	1, 030		850	
Flagstones, walk ways, etc. ... square feet	1, 248, 190	124, 524	895, 230	100, 732
Approximate equivalent in short tons	8, 920		6, 710	
Granules and "flour" ... short tons	428, 940	2, 497, 743	289, 700	1, 695, 417
Total (quantities approximate, in short tons)	670, 070	11, 245, 178	463, 610	7, 911, 618

Value of slate imported for consumption in the United States, 1921–1930

1921	$2,923	1926	$86,681
1922	2,753	1927	78,909
1923	16,881	1928	44,778
1924	32,095	1929	95,073
1925	64,570	1930	48,065

Roofing slate exported from the United States, 1921–1930

Year	Number of squares	Value	Year	Number of squares	Value
1921	(1)	$101,630	1926	5,621	$53,117
1922	11,040	97,811	1927	6,798	80,171
1923	8,462	78,780	1928	12,236	119,187
1924	8,165	77,422	1929	10,376	121,367
1925	5,785	54,130	1930	5,278	64,343

[1] Quantity not recorded.

The following figures for exports of slate other than roofing were collected by the Bureau of Mines from shippers of the products named.

Slate other than roofing exported from the United States, 1928–1930, by uses

Use	1928		1929		1930	
	Quantity	Value	Quantity	Value	Quantity	Value
School slates ... cases [1]	14,320	$81,075	19,570	$108,135	16,280	$95,935
Electrical slate ... square feet	23,190	19,102	16,720	18,037	18,830	20,406
Blackboards ... do	160,680	63,526	188,720	74,610	177,760	59,810
Billiard tables ... do	65,620	45,010	20,150	34,455	15,760	9,802
Structural ... do	14,440	7,741	18,390	15,882	12,670	5,280
Slate granules and "flour" ... short tons	13,990	82,140	14,250	84,185	27,540	162,000
		298,594		335,304		353,233

[1] Cases weigh from 130 to 165 pounds each; average is 135 pounds.

SOAPSTONE

[See Talc and soapstone]

SODIUM SALTS (NATURAL)

In addition to common salt, figures for which are given on page A76, the following quantities of other natural sodium salts (including carbonate, bicarbonate, sulphate, trona, and borate) and colemanite have been shipped by the producers.

Sodium salts (other than NaCl), derived from natural sources in the United States, shipped by producers, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	25,000	$894,000	1926	93,480	$2,326,750
1922	45,406	1,415,774	1927	145,770	3,834,324
1923	59,440	1,775,940	1928	206,380	5,272,228
1924	76,420	1,825,850	1929	275,190	6,107,666
1925	73,300	2,095,110	1930	297,440	6,897,504

Borates (colemanite and naturally occurring sodium borates) shipped by producers in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	50,000	$1,600,000	1926	115,970	$3,128,110
1922	85,220	2,705,140	1927	109,080	3,473,399
1923	136,650	3,994,790	1928	131,000	3,999,773
1924	116,110	3,183,910	1929	169,870	4,515,375
1925	113,700	3,085,660	1930	177,360	5,351,999

STEEL

[See Iron ore, pig iron, and steel]

STONE

Stone sold or used by producers in the United States, 1921–1930, by varieties

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	4,752,180	$20,592,217	8,524,480	$11,450,899	315,400	$8,580,416	45,621,000	$57,749,594
1922	5,913,120	21,125,869	10,032,900	12,600,611	427,870	10,534,671	58,928,660	68,397,927
1923	7,300,130	29,704,796	10,674,470	13,539,648	562,560	12,863,974	76,701,360	89,620,007
1924	6,883,860	28,772,161	11,671,500	14,679,523	516,000	13,302,235	75,894,430	89,868,956
1925	8,074,200	30,531,347	11,842,110	14,770,042	564,150	13,882,457	85,649,440	98,008,028
1926	9,330,390	32,044,523	12,977,740	15,950,302	563,170	14,167,480	91,887,900	109,252,299
1927	10,706,740	35,287,206	13,210,570	17,399,949	600,060	15,625,872	99,662,270	112,439,824
1928	9,556,500	33,994,527	15,327,760	19,693,945	579,490	16,402,986	96,864,650	110,231,974
1929	10,826,730	34,225,110	14,871,780	18,946,197	553,660	16,545,312	100,686,960	113,966,071
1930	10,047,430	30,423,853	14,532,250	17,053,031	477,240	12,905,596	88,741,440	100,002,114

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	2,640,460	$6,425,339	1,685,220	$2,163,801	63,538,740	$106,962,266
1922	3,388,130	7,521,044	1,520,880	1,886,806	80,211,560	122,066,928
1923	4,349,270	9,174,706	3,730,870	4,567,110	103,318,660	159,470,241
1924	3,894,690	10,142,099	4,323,640	5,105,139	103,184,120	161,870,113
1925	4,479,330	10,920,016	5,242,140	6,104,902	115,851,370	174,216,792
1926	4,978,530	11,149,029	4,758,630	5,744,957	124,496,360	188,308,590
1927	5,050,600	10,923,035	7,114,890	6,971,336	136,345,130	198,647,222
1928	4,716,530	10,498,440	6,824,580	5,998,825	133,869,510	196,820,697
1929	5,790,200	11,023,981	8,380,250	8,046,091	141,109,580	202,692,762
1930	4,594,310	10,285,391	8,603,670	8,278,626	126,996,340	178,948,611

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[1] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

Stone sold or used by producers in the United States, 1929 and 1930, by uses

Use	1929		1930	
	Quantity	Value	Quantity	Value
Building stone ..... cubic feet	34, 761, 140	$43, 905, 123	30, 169, 270	$39, 111, 527
Approximate equivalent in short tons	2, 647, 410		2, 321, 650	
Monumental stone ..... cubic feet	4, 410, 140	15, 848, 126	3, 517, 870	13, 157, 550
Approximate equivalent in short tons	366, 230		290, 720	
Paving blocks ..... number	31, 849, 130	2, 942, 991	31, 586, 260	2, 669, 511
Approximate equivalent in short tons	300, 360		294, 560	
Curbing ..... cubic feet	4, 054, 700	3, 843, 961	3, 358, 583	3, 176, 102
Approximate equivalent in short tons	336, 360		262, 170	
Flagging ..... cubic feet	1, 129, 690	666, 987	1, 095, 780	705, 775
Approximate equivalent in short tons	87, 750		81, 680	
Rubble ..... short tons	907, 810	1, 324, 681	1, 066, 590	921, 937
Riprap ..... do	4, 212, 990	5, 030, 743	4, 292, 030	4, 739, 122
Crushed stone ..... do	92, 721, 260	94, 387, 878	87, 110, 890	87, 554, 354
Furnace flux (limestone and marble) ..... do	24, 393, 500	18, 034, 910	17, 090, 710	12, 362, 159
Refractory stone (ganister, mica schist, and dolomite) ..... short tons	1, 558, 200	1, 807, 324	1, 197, 500	1, 406, 776
Agricultural limestone ..... do	2, 654, 580	3, 764, 775	2, 542, 100	3, 309, 329
Manufacturing industries (limestone and marble) ..... short tons	7, 430, 750	6, 361, 201	6, 021, 200	5, 324, 274
Other ..... do	3, 492, 380	4, 774, 062	4, 424, 540	4, 510, 195
Total (quantities approximate, in short tons)	141, 109, 580	202, 692, 762	126, 996, 340	178, 948, 611

Value of stone imported for consumption in the United States, 1921–1930

1921	$1, 253, 959	1926	$3, 523, 578
1922	1, 895, 912	1927	4, 536, 407
1923	2, 641, 337	1928	3, 491, 353
1924	2, 437, 654	1929	3, 589, 259
1925	2, 909, 887	1930	3, 145, 861

Stone imported for consumption in the United States, 1929 and 1930, by kinds

Kind	1929		1930	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
In blocks, rough, etc ..... cubic feet	667, 900	$1, 591, 070	717, 436	$1, 578, 856
Sawed ..... do	10, 859	24, 799	797	2, 983
Slabs or paving tiles ..... superficial feet	649, 899	253, 267	591, 616	254, 179
All other manufactures		566, 010		329, 279
Mosaic cubes of marble or onyx:				
Loose		1, 875		9, 383
Attached to paper		33		2, 774
		2, 437, 054		2, 177, 454
Granite:				
Dressed		292, 644		226, 318
Rough ..... cubic feet	216, 022	378, 943	138, 831	202, 037
		671, 587		428, 355
Quartzite ..... short tons	(1)	(1)	[2] 102, 032	[2] 174, 334
Travertine stone, unmanufactured ..... cubic feet	(1)	(1)	[2] 74, 163	[2] 64, 997
Stone (other):				
Dressed		62, 674		23, 396
Rough (monumental or building stone) ..... cubic feet	240, 399	184, 620	214, 424	203, 417
Rough (other)		233, 324		73, 908
		480, 618		300, 721
Grand total		3, 589, 259		3, 145, 861

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[1] Not separately recorded.

[2] Figures cover June 18 to December 31; not separately recorded prior to change in tariff

Value of stone exported from the United States, 1921–1930

Year	Marble in blocks, rough or dressed, and other building or monumental stone [1]	Other manufactures of stone [1]	Total	Year	Marble in blocks, rough or dressed, and other building or monumental stone [1]	Other manufactures of stone [1]	Total
1921	$576, 905	$1, 697, 570	$2, 274, 475	1926	$687, 115	$896, 130	$1, 583, 245
1922	681, 658	903, 102	1, 584, 760	1927 [2]	[3] 1, 088, 949	[4] 1, 005, 636	2, 094, 585
1923	625, 442	784, 195	1, 408, 637	1928 [2]	[3] 727, 432	[4] 1, 245, 792	1, 973, 224
1924	499, 602	448, 731	948, 333	1929 [2]	[3] 1, 077, 286	[4] 1, 487, 993	2, 565, 279
1925	507, 391	725, 677	1, 233, 068	1930 [2]	[3] 970, 141	[4] 1, 066, 584	2, 036, 725

[1] Exports classification beginning 1922; prior to 1922 classification read "Stone including marble—unmanufactured and all other."

[2] Beginning 1927 figures not separately recorded for stone and for cement building blocks and for stone and for cement manufactures.

[3] Composed in 1927 of "marble in blocks, rough or dressed," $237,233, and "other building or monumental stone (including cement building blocks)," $851,716; in 1928 of $254,266 and $473,166; in 1929 of $394,654 and $682,632; and in 1930 of $375,964 and $594,177, respectively.

[4] Classification reads "Other manufactures of stone (including other cement manufactures)."

STRONTIUM

No domestic production of strontium ore has been reported since 1918. The canvass has been discontinued.

Strontium chemicals, manufactured in the United States from domestic and imported crude ore, sold in 1921–1924 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	847, 368	$118, 655	1923	2, 676, 260	$303, 719
1922	2, 040, 550	204, 022	1924	3, 061, 532	303, 456

[1] Canvass discontinued after 1924.

Strontium ore imported for consumption in the United States, 1922–1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1922 (Sept. 22 to Dec. 31)	([2])	$40	1927	1, 356	$58, 711
1923	1, 679	12, 564	1928	759	31, 157
1924	1, 661	14, 487	1929	973	45, 505
1925	1, 132	22, 082	1930	220	10, 459
1926	2, 200	58, 159			

[1] Not separately recorded prior to change in tariff, Sept. 22, 1922. [2] 1,000 pounds.

Strontium chemicals and ore imported for consumption in the United States, 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	1, 212, 758	$4, 393	1926	5, 433, 044	$115, 436
1922 [1]	390, 644	22, 986	1927	4, 253, 816	149, 383
1923	5, 281, 818	131, 420	1928	3, 380, 464	136, 561
1924	3, 993, 226	59, 937	1929	4, 578, 327	196, 233
1925	4, 826, 612	162, 533	1930	2, 153, 788	104, 807

[1] Celestite (strontium sulphate ore), strontium nitrate, and some other chemicals not included in record prior to Sept. 22, 1922.

No exports of strontium ore or strontium chemicals have been reported.

SULPHUR

Sulphur produced and shipped in the United States, 1921–1930

Year	Produced (long tons)	Shipped		Year	Produced (long tons)	Shipped	
		Long tons	Approximate value			Long tons	Approximate value
1921	1, 879, 150	954, 344	$17, 000, 000	1926	1, 890, 027	2, 072, 657	$37, 300, 000
1922	1, 830, 942	1, 343, 624	22, 000, 000	1927	2, 111, 618	2, 072, 109	38, 300, 000
1923	2, 036, 097	1, 618, 841	26, 000, 000	1928	1, 981, 873	2, 082, 924	37, 500, 000
1924	1, 220, 561	1, 537, 345	25, 000, 000	1929	2, 362, 389	2, 437, 238	43, 800, 000
1925	1, 409, 262	1, 858, 003	29, 000, 000	1930	2, 558, 981	1, 989, 917	35, 800, 000

Sulphur imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value
1921	50	$5, 878	285, 762	$4, 524, 768
1922	296	14, 743	487, 969	7, 209, 357
1923	465	21, 535	474, 475	7, 216, 107
1924	1, 005	40, 293	484, 143	7, 894, 201
1925	100	4, 411	632, 250	11, 153, 781
1926	48	1, 052	582, 324	11, 154, 540
1927	3, 384	34, 487	803, 300	16, 798, 600
1928	4, 787	21, 320	704, 933	15, 051, 841
1929	1, 163	6, 616	872, 846	18, 278, 053
1930	29	1, 523	609, 326	12, 972, 262

TALC AND SOAPSTONE

Talc and soapstone [1] sold by producers in the United States, 1921–1930, by classes

Year	Crude		Sawed and manufactured				Ground		Total	
			Talc		Soapstone					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	2, 150	$12, 911	(2)	(2)	[2] 17, 423	[2] $627, 826	102, 413	$1, 115, 205	121. 986	$1, 755, 942
1922	4, 981	22, 582	654	$86, 333	22, 700	712, 144	170, 349	2, 038, 838	198. 684	2, 859, 897
1923	5, 706	50, 125	682	114, 772	22, 857	932, 098	167, 447	1, 915, 258	196, 692	3, 012, 253
1924	5, 710	22, 247	846	109, 405	25, 630	1, 288, 885	171, 635	2, 095, 019	203, 821	3, 515, 556
1925 [1]	5, 684	24, 533	895	107, 691	(3)	(3)	175, 677	1, 879, 569	182, 256	2, 011, 793
1926 [1]	5, 988	26, 723	1, 528	130, 253	(3)	(3)	174, 052	1, 954, 018	181, 568	2, 110, 994
1927 [1]	5, 706	25, 365	1, 494	111, 650	(3)	(3)	185, 116	2, 097, 709	192, 316	2, 234, 724
1928 [1]	6, 360	48, 031	936	70, 394	(3)	(3)	195, 680	2, 419, 569	202, 976	2, 537, 994
1929 [1]	11, 228	87, 820	473	140, 928	(3)	(3)	208, 082	2, 399, 914	219, 783	2, 628, 662
1930 [1]	4, 972	48, 913	385	90, 370	(3)	(3)	174, 028	1, 969, 055	179, 385	2, 108, 338

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[1] Beginning 1925, figures represent talc only; Bureau of Mines not at liberty to publish figures for soapstone.

[2] Talc included under "Soapstone."

[3] Bureau of Mines not at liberty to publish figures.

Talc imported for consumption in the United States, 1921–1930

Year	Crude and unground steatite and French chalk		Manufactures (except toilet preparations) wholly or partly finished [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	153	$2,279	11,468	$239,469	11,621	$241,748
1922	248	9,850	18,196	367,528	18,444	377,378
1923	560	20,653	19,405	402,238	19,965	422,891
1924	313	4,847	17,496	337,508	17,809	342,355
1925	121	6,547	20,872	443,985	20,993	450,532
1926	199	16,366	23,642	523,716	23,841	540,082
1927	377	27,326	24,817	523,056	25,194	550,382
1928	459	33,276	26,590	546,639	27,049	579,915
1929	1,228	74,840	29,949	596,789	31,177	671,629
1930	722	28,306	25,057	501,516	25,779	529,822

[1] Prior to change in tariff, Sept. 22, 1922, the classification was "Talc, steatite, and French chalk—cut, ground, or washed."

No material that might be classed as soapstone is imported.

Exports of "toilet powders—talcum powder, face powder, and compact" were valued at $1,484,338 in 1930; total quantity not recorded. Exports of talcum powder (in bulk), included in the foregoing total, amounted to 956,050 pounds, valued at $36,410. Exports of "powders—talcum, face, compact, and bath and other toilet powders" were valued at $1,592,301 in 1929; quantity not recorded. Exports of "talcum and other toilet powders" from 1922 to 1928 were as follows: 1928, 1,568 short tons, valued at $1,605,630; 1927, 1,627 tons, $1,621,068; 1926, 1,645 tons, $1,726,933; 1925, 1,734 tons, $1,882,196; 1924, 1,614 tons, $1,688,211; 1923, 1,907 tons, $1,671,588; 1922, 1,821 tons, $1,397,542. Exports were not separately recorded prior to 1922.

TANTALUM

Columbite, mined in the United States, shipped in 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	3,400	$1,150	1927	1,100	$378
1922	600	240	1928	34,899	26,332
1923	1,350	540	1929	22,117	17,261
1924	1,197	598	1930	5,100	3,350
1926	2,100	650			

[1] No shipments reported for 1925.

Tantalum ores imported into the United States, 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	[2] 1,229 [3] 6,785	$788 1,327	1926	[4] 350	$149
			1927	[4] 15,119	20,012
1923	[4] 5,600	3,031	1929	[4] 15,250	19,418
1925	[4] 5,022	1,347	1930	[4] 8,474	7,036

[1] No imports reported for 1922, 1924, and 1928.

[2] Classified as "Ferro-alloys (tantalum)."

[3] Classified as "Steel-hardening ores (tantalum)."

[4] Classified as "Ores of ferro-alloying metals (tantalum)."

No separate record of exports is kept.

TELLURIUM

Tellurium is a by-product of the electrolytic refining of copper.

Tellurium produced in the United States and sold by producers, 1926–1930 [1]

Year	Produced	Sold		Year	Produced	Sold	
		Pounds	Value			Pounds	Value
1926	917	1,106	$2,229	1929	11,410	1,309	$2,710
1927	1,659	1,003	1,913	1930	14,095	4,717	7,996
1928	2,590	932	1,731				

[1] Figures for years prior to 1926 not available for publication.

Imports and exports of tellurium are not reported.

THORIUM MINERALS

In 1925, 2,000 pounds of monazite, estimated to contain 6 per cent of thoria, was shipped from Florida; the value of this monazite is estimated by the Bureau of Mines as $120. No monazite is known to have been produced in the United States from 1921 to 1924 or from 1926 to 1930.

Monazite sand and thorium nitrate imported for consumption in the United States, 1921–1930

Year	Monazite sand		Thorium nitrate	
	Pounds	Value	Pounds	Value
1921	50	$40	44,554	$89,672
1922	3,466,844	210,187	43,254	42,096
1923	253,730	11,334	24,027	29,789
1924	546,560	18,320	14,150	13,721
1925	----------	----------	21,519	22,661
1926	669,760	23,816	21,403	27,955
1927	1,193,920	41,029	10,492	13,514
1928	884,800	24,151	12,431	14,149
1929	1,153,600	26,114	10,164	11,384
1930	----------	----------	4,025	4,181

Exports of thorium nitrate in 1922 amounted to 1,103 pounds, valued at $3,149. Data for other years are not separately shown.

TIN

Tin mined in the United States (including Alaska), 1921–1930

[Metallic tin obtainable from concentrates produced in tin mining]

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1921	4	$2,400	1926	8	$10,400
1922	[2] 1	912	1927	27	34,600
1923	2	1,623	1928	47	47,400
1924	7	7,028	1929	39	35,600
1925	14	15,980	1930	17	10,500

[1] Value calculated at average price per pound of Straits tin in New York, as published by American Metal Market.

[2] 2,800 pounds.

Smelter production of metallic tin in the United States, 1921–1930, in short tons [1]

1921	11,542	1923	7,466
1922	9,108	1924	486

[1] No production reported from 1925 to 1930.

Secondary tin recovered as metal and in alloys and chemical compounds in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	16,900	$9,668,500	1926	33,400	$42,511,500
1922	19,510	12,443,500	1927	36,900	46,302,100
1923	30,210	25,316,000	1928	35,800	35,678,300
1924	31,300	31,062,100	1929	34,300	30,513,300
1925	30,950	35,165,400	1930	26,200	16,228,300

Metallic tin imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	27,101	$16,645,719	1926	86,418	$104,793,396
1922	67,416	40,797,986	1927	79,679	100,865,205
1923	77,206	61,092,354	1928	87,327	86,983,174
1924	72,866	68,953,193	1929	97,583	91,838,781
1925	85,843	95,121,111	1930	90,422	60,233,644

Tin ore (concentrate) imported into the United States, 1921–1930

[General imports]

Year	Short tons	Value	Year	Short tons	Value
1921	15,340	$5,672,861	1926	[1] 339	$187,396
1922	13,804	5,504,434	1927	[1] 137	79,089
1923	3,015	2,169,055	1928	[1] 146	69,227
1924	[1] 174	71,094	1929	[1] 143	66,609
1925	[1] 214	98,489	1930	[1] 324	177,120

[1] Recorded as tin content.

Exports of tin ore are insignificant.

Metallic tin (pigs, bars, etc.) of domestic manufacture exported from the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	1,154	$748,077	1926	756	$708,151
1922	901	574,792	1927	1,131	888,563
1923	840	646,250	1928	391	325,668
1924	469	453,482	1929	884	781,156
1925	404	445,782	1930	94	59,798

TITANIUM MINERALS

Titanium minerals produced in the United States, 1921–1930 [1]

Year	Rutile concentrates			Ilmenite concentrates		
	Short tons	Percentage of TiO_2	Value	Short tons	Percentage of TiO_2	Value
1922	310	95	(2)	5,181	52–54	(2)
1923	270	95	(2)	6,270	52	(2)
1924	----	----	----	4,769	52	[3] $76,300
1925	46	95	[3] $11,000	5,566	52	[3] 89,000
1926 [4]	30	95	[3] 7,500	4,813	52	[3] 77,000
1927	524	95	129,861	3,500	50	44,000
1928	176	93–96	[3] 37,700	918	50	[3] 21,000
1929	(2)	(2)	(2)	(2)	(2)	(2)
1930	(2)	(2)	(2)	(2)	(2)	(2)

[1] No production reported for 1921.

[2] Bureau of Mines not at liberty to publish figures.

[3] Estimate by Bureau of Mines.

[4] Figures for Florida only. Bureau of Mines not at liberty to publish figures for Virginia.

No imports of "titanium steel-hardening" ores have been recorded since 1918, although ilmenite is known to have been imported from Senegal, West Africa; from Brazil; from Travancore, India; and possibly from other places. Such imports were not separately recorded by the Bureau of Foreign and Domestic Commerce until 1928, when 17,224 short tons of ilmenite, valued at $79,640, were imported. Imports in 1929 and 1930 were recorded as follows: 25,072 short tons of ilmenite, valued at $104,887, and 6 short tons of rutile, valued at $1,463, in 1929 and 24,973 tons of ilmenite, valued at $150,466, and 3 tons of rutile, valued at $974, in 1930. For imports of ferrotitanium see Ferro-alloys.

No separate record of exports of titanium, "titanium steel-hardening" ores, or ferrotitanium is kept.

TRIPOLI

[See Abrasive materials]

TUNGSTEN

Concentrated tungsten ores (reduced to equivalent of 60 per cent of tungsten trioxide), produced in the United States, sold in 1921–1930 [1]

Year	Short tons	Value	Year	Short tons	Value
1923	241	$144,600	1927	1,164	$724,000
1924	565	287,000	1928	1,208	753,900
1925	1,191	755,500	1929	830	654,000
1926	1,382	920,400	1930	702	509,000

[1] No sales reported for 1921 and 1922.

Tungsten-bearing ore [1] *imported for consumption in the United States, 1921–1930* [2]

Year	Short tons	Value	Year	Short tons	Value
1921	1,614	$276,757	1927	1,085	$540,409
1922	1,651	279,190	1928	1,428	672,199
1925	427	206,326	1929	2,987	1,703,711
1926	1,267	566,996	1930	1,847	1,534,769

[1] Prior to Sept. 22, 1922, imports recorded as ore; beginning with change in tariff, recorded as tungsten content of ore.

[2] No imports reported for 1923 and 1924.

For imports of tungsten and ferrotungsten see Ferro-alloys.

For 1922 the following domestic exports are recorded: "Tungsten ores and concentrates (tungsten content)," 717 pounds, valued at $594. No tungsten ores of domestic production are recorded as exported in 1921, and, although exports for later years are not separately shown, it is practically certain that no domestic ores have been exported.

For exports of tungsten and ferrotungsten see Ferro-alloys.

URANIUM AND VANADIUM ORES

Uranium and vanadium ores shipped from mines in the United States, 1921–1930

Year	Ores		Radium isolated (grams)	Estimated content of ores		
	Short tons	Approximate value as ore		Radium (grams)	Uranium (short tons)	Vanadium (short tons)
1921	8, 540	$876, 000	35. 693	33. 0	109. 0	201. 5
1922	929	166, 016	24. 189	7. 0	23. 2	25. 9
1923	2, 025	150, 000	12. 212	5. 5	18. 2	63. 3
1924	(1)	(1)	8. 042	(1)	(1)	(1)
1925	13, 070	331, 000		4. 3	14. 3	216. 0
1926	21, 624	329, 000		. 4	1. 2	330. 7
1927	(1)	(1)		(1)	(1)	(1)
1928	(1)	(1)		(1)	(1)	(1)
1929	(1)	(1)		. 2	. 6	(1)
1930	(1)	(1)		. 2	. 7	(1)

[1] Bureau of Mines not at liberty to publish figures.

Value of uranium salts and oxide, including radium salts, imported for consumption in the United States, 1921–1930

1921	$8, 552	1926	$596, 433
1922	28, 685	1927	452, 633
1923	500, 456	1928	715, 447
1924	418, 307	1929	923, 816
1925	480, 889	1930	1, 232, 389

No imports of "uranium-radium ore (steel-hardening)" were recorded for 1922 to 1930. Imports in 1921 were 250 pounds, valued at $446.

Vanadium ore (steel-hardening) imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	5, 154	$543, 061	1926	8, 368	$914, 114
1922	306	86, 776	1927	6, 943	561, 051
1923	2, 089	229, 210	1928	552	49, 771
1924	7, 058	722, 731	1929	9, 760	794, 734
1925	2, 368	339, 468	1930	5, 788	491, 633

For imports of ferrovanadium see Ferro-alloys.

No separate record is kept of vanadium exports. For exports of ferrovanadium see Ferro-alloys.

ZINC [1]

Primary zinc produced in the United States from domestic ores, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	198, 232	$19, 823, 000	1926	611, 991	$91, 799, 000
1922	353, 274	40, 273, 000	1927	576, 960	73, 851, 000
1923	508, 335	69, 134, 000	1928	591, 525	72, 166, 000
1924	515, 831	67, 058, 000	1929	612, 136	80, 802, 000
1925	555, 631	84, 456, 000	1930	489, 361	46, 979, 000

[1] For prices of zinc, see statement on p. A14.

Primary zinc produced in the United States, 1926–1930, by sources of ore, in short tons

Source	1926	1927	1928	1929	1930
United States	611, 991	576, 960	591, 525	612, 136	489, 361
Foreign (all from Mexico)	6, 431	15, 556	11, 056	13, 311	8, 684
	618, 422	592, 516	602, 581	625, 447	498, 045

Primary zinc produced in the United States, 1926–1930, by method of reduction and by location of reduction plant, in short tons

	1926	1927	1928	1929	1930
Distilled:					
Arkansas	32, 712	26, 317	20, 505	17, 923	13, 917
Illinois	110, 381	102, 768	103, 765	110, 791	94, 582
Kansas	33, 671	33, 144	33, 923	37, 795	13, 682
Oklahoma	136, 560	120, 801	106, 557	111, 683	79, 742
Pennsylvania	100, 538	106, 099	108, 802	108, 167	101, 916
Other States	92, 964	90, 758	68, 869	82, 853	63, 040
Electrolytic:					
Idaho			1, 939	16, 582	9, 509
Illinois				1, 634	8, 749
Montana	111, 596	112, 629	158, 221	138, 019	112, 908
	618, 422	592, 516	602, 581	625, 447	498, 045

Secondary zinc recovered as metal in the United States, 1921–1930, in short tons

Year	Redistilled	Remelted	Recovered in alloys, excluding old brass remelted	Recovered in remelted brass (estimate)
1921	17, 573	16, 260	5, 840	38, 600
1922	32, 988	36, 326	10, 250	60, 000
1923	39, 434	25, 776	8, 630	65, 000
1924	35, 486	23, 400	10, 500	63, 000
1925	39, 181	22, 249	13, 300	53, 300
1926	40, 799	23, 771	13, 430	63, 000
1927	42, 784	22, 016	12, 400	63, 200
1928	48, 666	22, 034	12, 500	66, 000
1929	47, 348	18, 052	11, 600	65, 670
1930	[1] 34, 849	14, 451	7, 700	42, 300

[1] Includes 22 tons of secondary electrolytic.

Zinc imported for consumption in the United States, 1921–1930

Year	Blocks or pigs		Sheets		Old		Zinc dust		Manufactures	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1921	6, 598	$559, 870	6, 688	$496, 445	6	$341	42	$1, 121	$8, 290	$1, 066, 067
1922	40	3, 327	416	59, 037	46	2, 403	79	5, 614	9, 517	79, 898
1923	1	375	(1)	41	20	1, 624	4	891	16, 331	19, 262
1924	11	1, 973	(1)	88	14	1, 493	59	9, 241	20, 089	32, 884
1925	(1)	303	(1)	55	24	2, 495	116	20, 936	18, 979	42, 768
1926	(1)	195	(1)	46	21	1, 315	2	451	44, 574	46, 581
1927	39	5, 089	1	271	19	1, 443	(1)	114	91, 519	98, 436
1928	(1)	66	3	2, 556	3	260	146	14, 147	115, 784	132, 813
1929	226	21, 502	(1)	52	(1)	20	159	19, 543	128, 395	169, 512
1930	281	25, 389	65	6, 420	[2] 35	[2] 1, 968	76	7, 086	76, 062	116, 925

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[1] Less than 1 ton.

[2] Includes 33 tons of dross and skimmings, valued at $1,829, imported June 18 to Dec. 31; not separately recorded prior to change in tariff.

Zinc content of zinc ores[1] imported for consumption in the United States, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	9,387	$252,951	1926	[2] 55	$4,181
1922	[2] 1,895	18,903	1927	[2] 154	10,401
1923	[2] 2,007	273,105	1928	[2] 344	19,121
1924	[2] 332	32,850	1929	[2] 2,631	208,428
1925	[2] 57	6,205	1930	[2] 590	46,549

[1] Classification as follows: 1921 and 1922, "Ore, zinc-bearing, including calamine (zinc content)"; 1923 to June 17, 1930, "Zinc ores (zinc content)"; June 18 to Dec. 31, 1930, "Zinc ores (except pyrites, not more than 3 per cent zinc) (zinc content)."

[2] Content of ore imported duty free and containing less than 10 per cent of zinc is separately recorded after Sept. 21, 1922, but is excluded from figures as zinc content is not recovered.

Zinc exported from the United States, 1921–1930

Year	Domestic				Foreign slabs	
	Slabs		Sheets			
	Short tons	Value	Short tons	Value	Short tons	Value
1921	1,753	$204,984	1,816	$425,618	1,256	$100,677
1922	26,815	2,994,625	3,217	574,491	3,471	429,122
1923	42,131	5,961,525	3,732	764,369	7,080	941,257
1924	[1] 72,583	[1] 9,538,459	3,658	784,728	(1)	(1)
1925	[1] 76,351	[1] 11,654,441	4,196	926,841	(1)	(1)
1926	[1] 42,920	[1] 6,360,671	4,641	1,086,967	(1)	(1)
1927	[1] 45,695	[1] 6,035,382	3,922	869,425	(1)	(1)
1928	[1] 25,289	[1] 3,013,679	4,325	906,515	(1)	(1)
1929	[1] 14,411	[1] 1,879,039	5,265	1,075,000	(1)	(1)
1930	[1] 4,633	[1] 450,417	3,868	761,007	(1)	(1)

[1] Foreign included with domestic; not separately recorded after 1923.

ZINC RESIDUUM

[See Manganiferous zinc residuum]

ZIRCONIUM MINERALS

The Bureau of Mines is advised that shipments of zircon from Pablo Beach, Fla., during the decade 1921 to 1930 were as follows:

Zircon, produced in the United States, shipped in 1921–1930[1]

Year	Short tons	Value (estimate by Bureau of Mines)	Year	Short tons	Value (estimate by Bureau of Mines)
1922	10	$1,000	1926	1,292	$129,200
1923	153	15,300	1927	3,646	364,600
1924	281	28,100	1928	(2)	(2)
1925	624	62,400			

[1] No shipments reported for 1921, 1929, and 1930.

[2] Bureau of Mines not at liberty to publish figures.

Zirconium ores (steel-hardening) imported for consumption in the United States, 1921–1930[1]

Year	Pounds	Value	Year	Pounds	Value
1921	131,016	$3,003	1928	863,685	$9,788
1922	67,037	4,072	1929	2,689,120	35,416
1924	616,220	4,878	1930	3,038,599	40,416
1927	4,488	182			

[1] No imports reported for 1923, 1925, and 1926.

STATE TABLES

Mineral production of Alabama in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asphalt (native)........short tons	(1)	(1)	(1)	(1)
Bauxite........long tons	(1)	(1)	(1)	(1)
Cement........barrels	[2] 5, 228, 947	[2] $5, 911, 031	[2] 4, 689, 516	[2] $5, 829, 818
Clay products	------------	[3] 4, 001, 633	------------	[3] 2, 295, 334
Clay, raw........short tons	108, 019	[4] 185, 140	86, 698	[4] 124, 791
Coal........do	17, 943, 923	37, 309, 000	15, 570, 058	31, 616, 000
Coke........do	4, 753, 967	[4] 12, 659, 148	3, 986, 920	[4] 10, 741, 937
Ferro-alloys........long tons	(1 4)	(1 4)	(1 4)	(1 4)
Gold........troy ounces	10	203	22	450
Graphite, crystalline........pounds	(1)	(1)	(1)	(1)
Iron ore........long tons	6, 637, 299	12, 575, 113	5, 637, 678	11, 015, 336
Iron, pig........do	2, 697, 814	[4] 43, 674, 910	2, 294, 513	[4] 31, 083, 905
Lime........short tons	209, 260	1, 223, 623	164, 822	929, 302
Manganiferous ore........long tons	475	5, 854	321	2, 618
Mica, sheet........pounds	(1)	(1)	(1)	(1)
Mineral waters........gallons sold	(5)	(5)	(5)	(5)
Sand and gravel........short tons	2, 371, 545	1, 229, 424	1, 515, 160	901, 088
Silver........troy ounces	1	1	3	1
Stone........short tons	1, 262, 120	2, 249, 601	967, 320	2, 111, 340
Miscellaneous [6]	------------	1, 427, 126	------------	1, 919, 340
Total value, eliminating duplications	------------	65, 402, 354	------------	55, 461, 985

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[1] Value included under "Miscellaneous."
[2] Exclusive of puzzolan, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] No canvass.
[6] Includes minerals indicated by "1" and "2" above.

Mineral production of Alaska in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Arsenic........short tons	(1)	(1)	------------	------------
Coal........do	100, 610	$528, 000	120, 100	$631, 000
Copper........pounds	40, 510, 000	7, 129, 760	32, 651, 000	4, 244, 630
Gold........troy ounces	375, 438	7, 761, 000	410, 027	8, 476, 000
Lead........short tons	1, 315	165, 690	1, 365	136, 500
Mercury........flasks (76 pounds)	(2)	(2)	(2)	(2)
Natural gas........M cubic feet	(2)	(2)	(2)	(2)
Natural gasoline........gallons	35, 000	4, 000	39, 000	5, 000
Ores (crude), etc.:				
Copper........short tons	590, 400	(3)	531, 000	(3)
Dry and siliceous (gold and silver)....do	3, 900, 000	(3)	3, 936, 000	(3)
Petroleum........barrels	(2)	(2)	(2)	(2)
Platinum and allied metals........troy ounces	251	19, 399	462	30, 547
Silver........do	472, 900	252, 055	408, 570	157, 299
Stone........short tons	(2)	(2)	------------	------------
Tin (metallic equivalent)........do	39	34, 900	15	9, 300
Miscellaneous [4]	------------	52, 026	------------	16, 959
Total value, eliminating duplications	------------	15, 946, 830	------------	13, 707, 235

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[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] Not valued as ore; value of recoverable metal content included under the metals.
[4] Includes minerals indicated by "2" above.

Mineral production of Arizona in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos ....short tons	934	$269, 785	683	$177, 912
Clay products		[1] 500, 215		[1] 236, 653
Clay, raw ....short tons	(1 2)	(1 2)	(1 2)	(1 2)
Coal ....do	10, 132	44, 000	9, 684	29, 000
Copper ....pounds	830, 628, 411	146, 190, 600	576, 190, 607	74, 904, 779
Feldspar (crude) ....long tons	(2)	(2)		
Gems and precious stones		(4)		(4)
Gold ....troy ounces	202, 318	4, 182, 287	169, 390	3, 501, 610
Gypsum ....short tons	(2)	(2)	(2)	(2)
Iron ore ....long tons			923	(2)
Lead ....short tons	8, 027	1, 011, 410	4, 246	424, 581
Lime ....do	42, 971	397, 308	35, 642	317, 881
Manganese ore ....long tons	2, 655	27, 826	364	(2)
Manganiferous ore ....do	45	181	48	(2)
Mercury ....flasks (76 pounds)	(2)	(2)	(2)	(2)
Molybdenum ....pounds	(2)	(2)		
Ores (crude), etc.:				
Copper ....short tons	25, 669, 975	(5)	19, 703, 349	(5)
Copper-lead and copper-lead-zinc ....do	19, 908	(5)	1, 309	(5)
Dry and siliceous (gold and silver) ....do	89, 904	(5)	53, 753	(5)
Lead ....do	46, 476	(5)	21, 807	(5)
Lead-zinc ....do	34, 421	(5)	22, 701	(5)
Zinc ....do	88	(5)		
Pumice ....do	46	321	110	770
Sand and gravel ....do	395, 386	329, 116	402, 796	361, 326
Silver ....troy ounces	7, 543, 283	4, 020, 570	5, 540, 732	2, 133, 182
Sodium sulphate from natural sources ....short tons			(2)	(2)
Stone ....do	616, 730	582, 406	589, 160	516, 886
Sulphuric acid [6] ....do	(2 3)	(2 3)	(2 3)	(2 3)
Tungsten ore (60 per cent concentrates) ....do	20	7, 215	1	(2)
Vanadium ores ....do	(2)	(2)	(2)	(2)
Zinc ....do	1, 229	162, 266	815	78, 264
Miscellaneous [7]		781, 938		556, 421
Total value, eliminating duplications		157, 959, 792		82, 933, 802

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] From copper smelting.
[7] Includes minerals indicated by "2" above.

Mineral production of Arkansas in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Bauxite ....long tons	351, 054	$2, 181, 158	315, 273	$1, 823, 389
Cement ....barrels	(1)	(1)	(1)	(1)
Clay products		[2] 2, 024, 403		[2] 1, 074, 103
Clay, raw ....short tons	574	[2] 2, 883	192	[2] 960
Coal ....do	1, 695, 108	5, 624, 000	1, 533, 434	5, 153, 000
Gems and precious stones		(4)		(4)
Iron ore sold for magnets ....long tons	5	(1)	5	(1)
Lead ....short tons	51	6, 426	53	5, 300
Lime ....do	33, 647	295, 816	30, 349	241, 938
Manganese ore ....long tons	4, 308	94, 396	3, 276	58, 172
Manganiferous ore ....do	13, 774	98, 826	12, 645	96, 964
Mineral waters ....gallons sold	(4)	(4)	(4)	(4)
Natural gas ....M cubic feet	19, 928, 000	3, 802, 000	18, 585, 000	3, 540, 000
Natural gasoline ....gallons	33, 455, 000	2, 419, 000	30, 637, 000	1, 757, 000
Oilstones ....short tons	171	115, 684	(1)	(1)
Ores (lead and zinc) ....do	(5)	(1)	(1)	(1)
Petroleum ....barrels	24, 917, 000	21, 890, 000	19, 702, 000	17, 390, 000
Sand and gravel ....short tons	3, 992, 336	1, 851, 755	2, 720, 756	1, 555, 408
Slate		(1)		(1)
Stone ....short tons	551, 730	761, 064	1, 034, 920	1, 203, 729
Tripoli ....do	345	3, 369	4, 364	83, 835
Zinc ....do	9	1, 188		
Miscellaneous [6]		155, 491		918, 638
Total value, eliminating duplications		41, 324, 576		34, 901, 476

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Figures not available.
[6] Includes minerals indicated by "1" above.

Mineral production of California in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos ... short tons			(1)	(1)
Asphalt (native) ... do	(1)	(1)	(1)	(1)
Barite ... do	24, 701	$147, 762	19, 517	$114, 310
Borates ... do	169, 870	4, 515, 375	177, 360	5, 351, 999
Briquets, fuel ... do	(1 2)	(1 2)	(1 2)	(1 2)
Bromine ... pounds	(1)	(1)	(1)	(1)
Calcium chloride ... short tons	(1)	(1)	(1)	(1)
Cement ... barrels	12, 964, 746	22, 805, 576	10, 438, 479	15, 241, 089
Chromite ... long tons	269	3, 976	80	1, 905
Clay products		[3] 22, 733, 974		[3] 16, 209, 437
Clay, raw ... short tons	307, 473	[2] 813, 171	527, 258	[2] 930, 381
Coal ... do	(1)	(1)	(1)	(1)
Copper ... pounds	33, 218, 994	5, 846, 543	27, 285, 272	3, 547, 085
Diatomite ... short tons	(1)	(1)	(1)	(1)
Feldspar (crude) ... long tons	12, 770	84, 567	6, 519	54, 941
Gems and precious stones		(4)		(4)
Gold ... troy ounces	412, 479	8, 526, 703	457, 200	9, 451, 162
Gypsum ... short tons	(1)	(1)	(1)	(1)
Iodine ... pounds	(1)	(1)	(1)	(1)
Iron ore sold for paint ... long tons	303	(1)		
Lead ... short tons	715	90, 058	1, 780	177, 978
Lime ... do	49, 753	526, 391	51, 302	498, 795
Lithium minerals ... do			(1)	(1)
Magnesite ... do	(1)	(1)	(1)	(1)
Magnesium salts (natural) ... pounds	(1)	(1)	(1)	(1)
Manganese ore ... long tons	569	8, 099	162	(1)
Marl, calcareous ... short tons	10, 274	46, 233	(1)	(1)
Mercury ... flasks (76 pounds)	10, 139	1, 238, 428	11, 451	1, 316, 968
Micaceous minerals (sericite) ... short tons	(1)	(1)		
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	342, 214, 000	68, 972, 000	334, 789, 000	69, 071, 000
Natural gasoline ... gallons	840, 325, 000	67, 009, 000	829, 713, 000	57, 974, 000
Ores (crude), etc.:				
Copper ... short tons	1, 080, 355	(5)	857, 786	(5)
Copper-lead ... do	24	(5)		
Dry and siliceous (gold and silver) ... do	573, 724	(5)	730, 712	(5)
Lead ... do	2, 966	(5)	6, 652	(5)
Peat ... do	(4)	(4)	(4)	(4)
Pebbles for grinding ... do	150	1, 098	15	127
Petroleum ... barrels	292, 534, 000	321, 367, 000	227, 329, 000	271, 699, 000
Platinum and allied metals ... troy ounces	181	13, 959	213	14, 106
Potassium salts ... short tons	(1)	(1)	(1)	(1)
Pumice ... do	10, 700	92, 734	11, 993	144, 621
Pyrites ... long tons	(1)	(1)	(1)	(1)
Salt ... short tons	410, 300	2, 432, 329	350, 370	2, 080, 133
Sand and gravel ... do	15, 688, 545	8, 371, 263	12, 604, 051	7, 354, 506
Sand and sandstone (finely ground) ... do	2, 969	30, 690	(1)	(1)
Sand-lime brick ... thousands	(1 3)	(1 3)		
Silica (quartz) ... short tons	5, 573	58, 807	2, 895	22, 762
Silver ... troy ounces	1, 176, 895	627, 285	1, 622, 803	624, 779
Slate		(1)		41, 377
Sodium salts (carbonate, bicarbonate, and trona) from natural sources ... short tons	102, 910	1, 916, 132	90, 200	1, 584, 556
Stone ... do	11, 818, 300	10, 861, 539	10, 690, 030	9, 794, 870
Sulphur ore ... long tons			(1)	(1)
Talc ... short tons	17, 620	256, 977	14, 993	219, 246
Tin (metallic equivalent) ... do	(6)	500		
Tungsten ore (60 per cent concentrates) ... do	(1)	(1)	(1)	(1)
Miscellaneous [7]		6, 418, 455		6, 464, 777
Total value, eliminating duplications		555, 001, 213		479, 049, 507

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[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] 1,000 pounds.
[7] Includes minerals indicated by "1" above.

Mineral production of Colorado in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Arsenious oxide .... short tons	163	$13,201	....	....
Cement .... barrels	(1)	(1)	(1)	(1)
Clay products	....	[2] 3,117,064	....	[2] $2,485,684
Clay, raw .... short tons	162,008	[3] 215,409	108,162	[3] 128,342
Coal .... do	9,920,741	26,254,000	8,196,910	21,485,000
Coke .... do	721,457	(1 3)	458,443	(1 3)
Copper .... pounds	8,905,074	1,567,293	10,514,000	1,366,820
Feldspar (crude) .... long tons	(1)	(1)	1,933	10,575
Ferro-alloys .... do	(1 3)	(1 3)	(1 3)	(1 3)
Fluorspar .... short tons	4,808	56,607	9,248	101,758
Fuller's earth .... do	(1)	(1)	(1)	(1)
Gems and precious stones	....	(4)	....	(4)
Gold .... troy ounces	213,690	4,417,358	218,540	4,517,619
Gypsum .... short tons	(1)	(1)	(1)	(1)
Iron ore .... long tons	50,754	(1)	32,247	(1)
Iron, pig .... do	(1 3)	(1 3)	(1 3)	(1 3)
Lead .... short tons	24,445	3,080,064	22,130	2,213,000
Lime .... do	7,046	76,791	6,777	73,156
Manganiferous ore .... long tons	17,770	(1)	19,730	109,796
Mica, scrap .... short tons	(1)	(1)	115	1,377
Micaceous minerals (vermiculite) .... do	(1)	(1)	(1)	(1)
Mineral paints, zinc and lead pigments .... do	(1 3)	(1 3)	(1 3)	(1 3)
Mineral waters .... gallons sold	(4)	(4)	(4)	(4)
Molybdenum .... pounds	(1)	(1)	(1)	(1)
Natural gas .... M cubic feet	2,787,000	675,000	3,312,000	958,000
Natural gasoline .... gallons	1,630,000	113,000	1,322,000	69,000
Ores (crude), etc.:				
Copper .... short tons	36,539	(5)	63,915	(5)
Copper-lead .... do	81	(5)	....	....
Dry and siliceous (gold and silver) .... do	640,442	(5)	710,491	(5)
Lead .... do	36,880	(5)	20,482	(5)
Lead-zinc .... do	458,251	(5)	540,843	(5)
Petroleum .... barrels	2,358,000	2,380,000	1,656,000	1,480,000
Sand and gravel .... short tons	982,866	492,587	929,888	442,303
Shale oil .... gallons	61,150	(6)	....	....
Silver .... troy ounces	4,397,377	2,343,802	4,382,852	1,687,398
Stone .... short tons	[7] 834,260	[7] 903,846	493,900	878,656
Sulphur ore .... long tons	....	....	(1)	(1)
Tungsten ore (60 per cent concentrates) .... short tons	152	124,416	47	37,050
Uranium and vanadium ores .... do	(1)	(1)	(1)	(1)
Zinc .... do	29,431	3,884,826	36,259	3,480,864
Miscellaneous [8]	....	17,741,885	....	13,177,309
Total value, eliminating duplications	....	55,331,911	....	46,270,545

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] No data available.
[7] Exclusive of marble, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Connecticut in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] [2] $2,038,539		[1] $1,547,524
Clay, raw ... short tons	516	[3] 5,779	608	[3] 4,561
Coke ... do	(3 4)	(3 4)	(3 4)	(3 4)
Feldspar (crude) ... long tons	2,726	21,056	(4)	(4)
Lime ... short tons	35,180	386,855	28,489	282,521
Mica:				
Scrap ... do	(4)	(4)	(4)	(4)
Sheet ... pounds	(4)	(4)	(4)	(4)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Sand and gravel ... short tons	850,390	566,410	670,501	446,973
Sand-lime brick ... thousands	(1 4)	(1 4)		
Stone ... short tons	[6] 2,621,260	[6] 3,496,520	2,436,520	3,187,815
Miscellaneous [7]		3,415,932		2,803,576
Total value, eliminating duplications		7,053,468		5,485,120

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Exclusive of pottery, value for which is included under "Miscellaneous."
[3] Value not included in total value for State.
[4] Value included under "Miscellaneous."
[5] No canvass.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "2," "4," and "6" above.

Mineral production of Delaware in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] $230,441		[1] $157,391
Clay, raw ... short tons	(2 3)	(2 3)	(2 3)	(2 3)
Sand and gravel ... do	78,055	59,266	74,897	55,193
Stone ... do	(2)	(2)	(2)	(2)
Miscellaneous [4]		257,596		264,182
Total value, eliminating duplications		467,493		424,901

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] Includes minerals indicated by "2" above.

Mineral production of the District of Columbia in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] [2] $194,908		[1] $298,441
Sand and gravel ... short tons	(3)	(3)	(3)	(3)
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Stone ... short tons	(3)	(3)	(3)	(3)
Miscellaneous [4]		870,038		989,903
Total value, eliminating duplications		1,064,946		1,288,344

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Exclusive of pottery, value for which is included under "Miscellaneous."
[3] Value included under "Miscellaneous."
[4] Includes minerals indicated by "2" and "3" above.

Mineral production of Florida in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement ....barrels	(1)	(1)	(1)	(1)
Clay products		[2,3] $281,741		[2] $137,543
Clay, raw ....short tons	40,904	[4] 544,848	(1 4)	(1 4)
Diatomite ....do	100	5,000		
Fuller's earth ....do	(1)	(1)	80,619	1,251,653
Lime ....do	(1)	(1)	(1)	(1)
Mineral waters ....gallons sold	(5)	(5)	(5)	(5)
Peat ....short tons	(5)	(5)	(5)	(5)
Phosphate rock ....long tons	3,088,298	9,901,074	3,248,071	10,790,305
Sand and gravel ....short tons	788,298	122,409	496,198	269,161
Sand-lime brick ....thousands	(1 2)	(1 2)	(1 2)	(1 2)
Stone ....short tons	2,267,140	1,688,224	[6] 1,796,670	[6] 1,490,173
Miscellaneous [7]		2,505,158		1,854,445
Total value, eliminating duplications		14,803,606		15,484,206

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Exclusive of pottery, value for which is included under "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1," "3," and "6" above.

Mineral production of Georgia in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos ....short tons	(1)	(1)	561	$10,000
Barite ....do	94,118	$546,212	41,746	230,769
Bauxite ....long tons	(1)	(1)	(1)	(1)
Cement ....barrels	(1)	(1)	(1)	(1)
Clay products		[2] 3,717,673		[2] 2,439,250
Clay, raw ....short tons	288,490	[3] 2,098,891	289,880	[3] 2,061,209
Coal ....do	44,636	136,000	7,092	18,000
Fuller's earth ....do	(1)	(1)	(1)	(1)
Gold ....troy ounces	125	2,574	203	4,194
Iron ore ....long tons	59,316	175,145	52,221	147,964
Lime ....short tons	10,757	77,239	7,455	50,655
Manganese ore ....long tons	2,521	(1)	18,897	(1)
Manganiferous ore ....do	5,310	57,432	12,009	(1)
Mica:				
Scrap ....short tons			(1)	(1)
Sheet ....pounds	4,218	594	(1)	(1)
Micaceous minerals (chlorite schist) ....short tons	(1)	(1)	(1)	(1)
Mineral waters ....gallons sold	(4)	(4)	(4)	(4)
Ore (dry and siliceous) (gold and silver) ....short tons	130	(5)	200	(5)
Sand and gravel ....do	604,611	235,299	586,929	228,396
Silver ....troy ounces	16	9	23	9
Slate		(1)		(1)
Stone ....short tons	977,910	6,417,329	[6] 772,650	[6] 2,374,994
Talc ....do	4,989	146,025	(1)	(1)
Tripoli ....do			(1)	(1)
Miscellaneous [7]		3,782,572		7,326,614
Total value, eliminating duplications		15,294,103		12,830,845

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of marble, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Idaho in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement...barrels	(1)	(1)	(1)	(1)
Clay products		[2] $151,320		[2] $122,710
Clay, raw...short tons	616	[3] 7,487	1,556	[3] 7,221
Coal...do	(1)	(1)	(1)	(1)
Copper...pounds	5,131,438	903,133	3,111,555	404,502
Diatomite...short tons			50	500
Gems and precious stones		(4)		(4)
Gold...troy ounces	20,247	418,545	21,445	443,309
Lead...short tons	148,695	18,735,538	134,058	13,405,798
Lime...do	(1)	(1)	2,463	25,156
Manganese ore...long tons	1,326	13,707		
Manganiferous ore...do	38	239	1,450	(1)
Ores (crude), etc.:				
Copper...short tons	91,782	(5)	33,129	(5)
Copper-lead...do	84,138	(5)	161,863	(5)
Dry and siliceous (gold and silver)...do	26,583	(5)	33,259	(5)
Lead...do	1,021,203	(5)	1,051,962	(5)
Lead-zinc...do	950,414	(5)	663,880	(5)
Zinc...do	5	(5)	807	(5)
Phosphate rock...long tons	35,899	141,931	59,932	234,543
Sand and gravel...short tons	661,993	243,173	353,839	169,755
Silver...troy ounces	9,414,403	5,017,877	9,420,639	3,626,946
Stone...short tons	313,660	335,957	536,810	513,752
Zinc...do	45,675	6,029,153	37,649	3,614,312
Miscellaneous [6]		152,112		342,376
Total value, eliminating duplications		32,142,685		22,903,659

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of Illinois in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement...barrels	[1] 7,738,208	[1] $11,134,538	[1] 7,951,680	[1] $10,519,162
Clay products		[2] 27,391,068		[2] 17,520,430
Clay, raw...short tons	264,332	[3] 553,797	184,555	[3] 371,645
Coal...do	60,657,641	113,453,000	53,731,230	93,484,000
Coke...do	4,204,116	[3] 26,036,197	3,576,577	[3] 21,379,784
Fluorspar...do	67,009	1,284,834	44,134	836,473
Fluorspar, optical...pounds	752	(4)	1,440	(4)
Fuller's earth...short tons	(4)	(4)	(4)	(4)
Grindstones...do			(4)	(4)
Iron, pig...long tons	4,316,096	[3] 79,672,295	3,050,743	[3] 54,290,144
Lead...short tons	443	55,818	248	24,800
Lime...do	119,382	973,312	89,709	721,143
Marl, calcareous...do	(4)	(4)	(4)	(4)
Mineral paints, zinc and lead pigments...do	17,234	[3] 2,149,882	11,239	[3] 1,385,464
Mineral waters...gallons sold	(5)	(5)	(5)	(5)
Natural gas...M cubic feet	2,983,000	388,000	2,890,000	505,000
Natural gasoline...gallons	7,080,000	617,000	6,867,000	420,000
Ore (lead and zinc)...short tons	(6)	(6)	(6)	(6)
Peat...do	(5)	(5)	(5)	(5)
Petroleum...barrels	6,319,000	10,430,000	5,736,000	9,100,000
Sand and gravel...short tons	18,256,203	9,071,238	17,398,693	8,382,025
Sand and sandstone (finely ground)...do	51,081	279,109	44,033	232,141
Silver...troy ounces	3,700	1,972	1,797	692
Stone...short tons	8,407,730	7,003,208	7,590,920	5,939,297
Sulphuric acid (60° Baumé) [7]...do	291,539	[3] 2,807,521	243,772	[3] 2,347,524
Tripoli...do	12,889	139,557	9,954	116,307
Zinc...do	31	4,092	9	864
Miscellaneous [8]		564,385		509,084
Total value, eliminating duplications		182,791,131		148,311,418

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Value included under "Miscellaneous."
[5] No canvass.
[6] No ore milled in Northern Illinois; lead output of Southern Illinois is by-product of fluorspar milling.
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "4" above.

Mineral production of Indiana in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement...barrels..	(1)	(1)	(1)	(1)
Clay products...	...	[2] $18, 503, 240	...	[2] $12, 032, 852
Clay, raw...short tons..	276, 610	[3] 254, 358	253, 795	[3] 216, 098
Coal...do...	18, 344, 358	29, 880, 000	16, 489, 962	26, 178, 000
Coke...do..	6, 455, 378	[3] 41, 208, 876	4, 984, 620	[3] 12, 166, 488
Iron, pig...long tons..	4, 279, 825	[3] 71, 416, 732	3, 195, 517	[3] 52, 869, 137
Lime...short tons..	116, 795	786, 814	87, 965	600, 784
Mineral paints, zinc and lead pigments..do..	(1 3)	(1 3)	(1 3)	(1 3)
Mineral waters...gallons sold..	(4)	(4)	(4)	(4)
Natural gas...M cubic feet..	1, 012, 000	518, 000	1, 217, 000	676, 000
Natural gasoline...gallons..	2, 000	(1)	2, 000	(1)
Peat...short tons..	(4)	(4)	(4)	(4)
Petroleum...barrels..	981, 000	1, 610, 000	994, 000	1, 610, 000
Potassium salts...short tons..	(1)	(1)	...	...
Rubbing stones and whetstones...do...	(1)	(1)	(1)	(1)
Sand and gravel...do...	10, 901, 798	5, 528, 832	9, 838, 757	4, 667, 771
Sand-lime brick...thousands..	(1 2)	(1 2)	(1 2)	(1 2)
Stone...short tons..	5, 129, 220	22, 191, 883	4, 541, 220	19, 285, 709
Sulphuric acid [5]...do...	(1 3)	(1 3)	(1 3)	(1 3)
Miscellaneous [6]...	...	20, 748, 550	...	15, 986, 721
Total value, eliminating duplications.....	...	96, 961, 947	...	79, 226, 808

[1] Value included under "Miscellaneous."

[2] Figures obtained through cooperation with Bureau of the Census.

[3] Value not included in total value for State.

[4] No canvass.

[5] From zinc smelting.

[6] Includes minerals indicated by "1" above.

Mineral production of Iowa in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel...short tons..	...	...	(1 2)	(1 2)
Cement...barrels..	6, 586, 111	$9, 781, 159	7, 035, 252	$10, 107, 584
Clay products...	...	[3 4] 5, 770, 125	...	[3] 4, 671, 487
Clay, raw...short tons..	3, 200	[2] 23, 281	6, 219	[2] 41, 816
Coal...do...	4, 241, 069	11, 948, 000	3, 892, 571	10, 385, 000
Ferro-alloys...long tons..	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum...short tons..	718, 503	4, 668, 856	481, 047	3, 741, 319
Lime...do...	(1)	(1)	...	...
Mineral waters...gallons sold..	(5)	(5)	(5)	(5)
Natural gas...M cubic feet..	(1)	(1)	(1)	(1)
Sand and gravel...short tons..	4, 043, 609	2, 211, 752	4, 521, 971	2, 599, 107
Stone...do...	1, 624, 400	1, 549, 743	[6] 1, 813, 860	[6] 1, 850, 832
Miscellaneous [7]...	...	1, 288, 027	...	1, 156, 113
Total value, eliminating duplications.....	...	35, 954, 895	...	33, 357, 958

[1] Value included under "Miscellaneous."

[2] Value not included in total value for State.

[3] Figures obtained through cooperation with Bureau of the Census.

[4] Exclusive of pottery, value for which is included under "Miscellaneous."

[5] No canvass.

[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1," "4," and "6" above.

Mineral production of Kansas in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement .... barrels..	[1] 6, 855, 861	[1] $10, 041, 282	[1] 5, 633, 098	[1] $8, 254, 416
Chats .... short tons..	89, 000	17, 000	30, 000	7, 500
Clay products	....	[2 3] 3, 279, 953	....	[2] 2, 315, 005
Coal .... short tons..	2, 975, 971	6, 697, 000	2, 429, 929	5, 231, 000
Gypsum .... do....	(4)	(4)	(4)	(4)
Lead .... do....	26, 596	3, 351, 096	12, 910	1, 291, 000
Mineral paints, zinc and lead pigments..do....	(4 5)	(4 5)	(4 5)	(4 5)
Mineral waters .... gallons sold..	(6)	(6)	(6)	(6)
Natural gas .... M cubic feet..	38, 469, 000	13, 429, 000	37, 630, 000	12, 459, 000
Natural gasoline .... gallons..	36, 227, 000	2, 207, 000	35, 106, 000	1, 570, 000
Ores (crude), etc.:				
Lead .... short tons..	69, 500	(7)	5, 000	(7)
Lead-zinc .... do....	3, 635, 900	(7)	2, 714, 300	(7)
Zinc .... do....	1, 615, 700	(7)	798, 000	(7)
Petroleum .... barrels..	42, 813, 000	62, 510, 000	41, 638, 000	54, 880, 000
Pumice .... short tons..	49, 768	195, 784	38, 024	134, 896
Salt .... do....	840, 370	3, 761, 984	759, 800	3, 148, 728
Sand and gravel .... do....	3, 389, 783	1, 879, 899	3, 232, 858	1, 649, 476
Stone .... do....	1, 419, 890	1, 461, 146	[8] 1, 248, 670	[8] 1, 245, 088
Zinc .... do....	109, 850	14, 500, 200	74, 304	7, 133, 184
Miscellaneous [9]	....	3, 092, 625	....	2, 182, 935
Total value, eliminating duplications.....	....	124, 472, 480	....	100, 253, 311

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Exclusive of pottery, value for which is included under "Miscellaneous."
[4] Value included under "Miscellaneous."
[5] Value not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of sandstone, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "1," "3," "4," and "8" above.

Mineral production of Kentucky in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asphalt (native) .... short tons..	340, 346	$2, 785, 772	305, 024	$2, 374, 834
Cement .... barrels..	(1)	(1)	(1)	(1)
Clay products	....	[2] 7, 062, 220	....	[2] 5, 563, 392
Clay, raw .... short tons..	153, 618	[3] 793, 099	203, 832	[3] 767, 253
Coal .... do....	60, 462, 600	93, 283, 000	51, 208, 995	76, 186, 000
Coke .... do....	(1 3)	(1 3)	(1 3)	(1 3)
Fluorspar .... do....	70, 827	1, 390, 603	39, 181	763, 370
Iron, pig .... long tons..	194, 150	(1 3)	85, 328	(1 3)
Lead .... short tons..	287	36, 162	101	10, 100
Lime .... do....	(1)	(1)	(1)	(1)
Mineral waters .... gallons sold..	(4)	(4)	(4)	(4)
Natural gas .... M cubic feet..	27, 588, 000	8, 822, 000	28, 023, 000	9, 691, 000
Natural gasoline .... gallons..	6, 006, 000	486, 000	6, 641, 000	385, 000
Ores (lead and zinc) .... short tons..	(5)	(5)	(5)	(5)
Petroleum .... barrels..	7, 775, 000	13, 220, 000	7, 389, 000	11, 080, 000
Sand and gravel .... short tons..	2, 350, 430	1, 581, 501	2, 029, 456	1, 553, 812
Stone .... do....	2, 447, 540	2, 587, 592	2, 628, 670	2, 635, 369
Miscellaneous [6]	....	7, 260, 435	....	4, 557, 985
Total value, eliminating duplications.....	....	132, 649, 508	....	111, 691, 254

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Figures not available.
[6] Includes minerals indicated by "1" above.

Mineral production of Louisiana in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)
Clay products		[2, 3] $583, 513		[2] $375, 750
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	261, 138, 000	26, 505, 000	278, 341, 000	35, 895, 000
Natural gasoline ... gallons	64, 957, 000	4, 010, 000	73, 693, 000	3, 725, 000
Petroleum ... barrels	20, 554, 000	25, 700, 000	23, 272, 000	26, 110, 000
Salt ... short tons	525, 840	2, 277, 366	535, 250	2, 164, 365
Sand and gravel ... do	3, 138, 673	2, 069, 024	3, 318, 965	2, 225, 211
Sand-lime brick ... thousands	(1 2)	(1 2)	(1 2)	(1 2)
Stone ... short tons	(1)	(1)	(1)	(1)
Miscellaneous [5]		1, 581, 094		1, 433, 712
Total value, eliminating duplications		62, 725, 997		71, 929, 038

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Exclusive of pottery, value for which is included under "Miscellaneous."
[4] No canvass.
[5] Includes minerals indicated by "1" and "3" above.

Mineral production of Maine in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)
Clay products		[2] $641, 364		[2] $459, 406
Clay, raw ... short tons	170	[3] 2, 952	175	[3] 1, 785
Feldspar (crude) ... long tons	19, 992	142, 042	22, 738	161, 631
Gems and precious stones		(4)		(4)
Lime ... short tons	92, 428	772, 443	66, 775	542, 115
Marl, calcareous ... do	(1)	(1)		
Mica:				
Scrap ... do	(1)	(1)	(1)	(1)
Sheet ... pounds	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Peat ... short tons	(4)	(4)	(4)	(4)
Sand and gravel ... do	2, 861, 271	447, 140	5, 215, 342	806, 545
Silica (quartz) ... do	(1)	(1)	(1)	(1)
Slate		653, 627		506, 322
Stone ... short tons	354, 500	2, 902, 603	318, 620	2, 252, 097
Miscellaneous [5]		1, 189, 580		1, 499, 412
Total value, eliminating duplications		6, 748, 799		6, 227, 528

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Maryland in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos ... short tons	(1)	(1)	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)
Clay products		[2] $5,115,816		[2] $3,513,008
Clay, raw ... short tons	37,775	[3] 120,022	47,563	[3] 95,568
Coal ... do	2,649,114	4,640,000	2,270,593	3,690,000
Coke ... do	1,393,052	(1 3)	1,169,016	(1 3)
Diatomite ... do	(1)	(1)		
Feldspar (crude) ... long tons	2,624	19,610		
Iron, pig ... do	1,111,219	(1 3)	981,466	(1 3)
Lime ... short tons	54,029	404,674	53,090	398,841
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Potassium salts ... short tons	(1)	(1)	(1)	(1)
Sand and gravel ... do	3,193,486	2,853,617	2,678,914	2,330,324
Silica (quartz) ... do	3,670	8,875	1,584	4,123
Slate		214,770		(1)
Stone ... short tons	1,163,630	1,915,014	[5] 1,215,730	[5] 2,028,021
Talc ... do	(1)	(1)	(1)	(1)
Miscellaneous [6]		28,251,973		24,785,653
Total value, eliminating duplications		18,469,568		14,989,695

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of marble, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Massachusetts in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel ... short tons	(1 2)	(1 2)	(1 2)	(1 2)
Clay products		[3] $2,571,951		[3] $1,718,790
Clay, raw ... short tons	11,791	[2] 25,717	9,109	[2] 12,911
Coke ... do	776,679	[2] 5,919,159	862,663	[2] 6,697,235
Fuller's earth ... do	(1)	(1)	(1)	(1)
Iron, pig ... long tons	(1 2)	(1 2)	(1 2)	(1 2)
Lime ... short tons	133,644	1,443,984	107,502	1,072,008
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Sand and gravel ... short tons	5,114,188	3,503,576	5,226,669	2,790,436
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz) ... short tons	(1)	(1)	765	5,500
Stone ... do	[5] 3,127,500	[5] 8,056,302	3,008,360	6,865,541
Miscellaneous [6]		4,046,124		2,459,968
Total value, eliminating duplications		16,030,807		12,722,974

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Exclusive of sandstone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Michigan in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel ....short tons..	....	....	([1] [2])	([1] [2])
Bromine ....pounds..	([1])	([1])	([1])	([1])
Calcium chloride ....short tons..	([1])	([1])	([1])	([1])
Cement ....barrels..	13,325,727	$18,916,711	10,817,994	$14,897,439
Clay products	....	[3] 6,217,018	....	[3] 4,891,647
Clay, raw ....short tons..	2,638	[2] 4,503	760	[2] 2,778
Coal ....do....	804,869	2,904,000	661,113	2,323,000
Coke ....do....	2,679,971	[2] 14,867,651	2,603,815	[2] 14,222,856
Copper ....pounds..	186,402,218	32,806,790	169,381,413	22,019,584
Ferro-alloys ....long tons..	([1] [2])	([1] [2])	....	....
Gems and precious stones	....	([4])	....	([4])
Graphite, amorphous ....short tons..	([1])	([1])	([1])	([1])
Grindstones ....do....	([1])	([1])	([1])	([1])
Gypsum ....do....	898,547	4,315,334	519,225	3,755,631
Iodine ....pounds..	([5])	([5])	([5])	([5])
Iron ore:				
Sold to furnaces ....long tons..	16,838,568	47,597,976	11,154,773	31,515,996
Sold for paint ....do....	1,514	([1])	1,648	([1])
Iron, pig ....do....	841,089	[2] 14,099,647	711,224	[2] 12,859,820
Lime ....short tons..	91,468	844,543	80,241	630,288
Magnesium ....pounds..	908,351	512,313	559,631	268,864
Magnesium chloride (natural) ....do....	([1])	([1])	([1])	([1])
Magnesium sulphate (natural) ....do....	([1])	([1])	([1])	([1])
Manganiferous ore ....long tons..	49,112	([1])	....	....
Mineral waters ....gallons sold..	([4])	([4])	([4])	([4])
Natural gas ....M cubic feet..	4,526,000	900,400	2,075,000	625,000
Ore (copper) ....short tons..	7,598,180	([6])	6,659,036	([6])
Peat ....do....	([4])	([4])	([4])	([4])
Petroleum ....barrels..	4,528,000	6,140,000	3,911,000	5,160,000
Salt ....short tons..	2,650,220	8,343,607	2,558,290	7,884,072
Sand and gravel ....do....	16,844,099	7,928,744	11,389,119	5,161,176
Sand-lime brick ....thousands..	[3] 96,511	[3] 1,107,708	[3] 45,391	[3] 551,187
Silver ....troy ounces..	20,795	11,084	7,820	3,011
Stone ....short tons..	[7] 13,586,230	[7] 8,454,702	[7] 10,561,120	[7] 6,816,972
Miscellaneous [8]	....	4,978,528	....	4,908,063
Total value, eliminating duplications	....	151,975,563	....	111,405,530

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Figures not available.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of basalt in 1929 and of unclassified stone in 1930, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Minnesota in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement ....barrels..	([1])	([1])	([1])	([1])
Clay products	....	[2] $2,085,697	....	[2] $1,647,007
Clay, raw ....short tons..	13,260	[3] 30,025	12,228	[3] 27,602
Coke ....do....	746,004	[3] 6,478,228	641,205	[3] 5,508,979
Flint lining for tube mills ....do....	([1])	([1])	([1])	([1])
Gems and precious stones	....	([4])	....	([4])
Iron ore ....long tons..	46,470,243	121,776,312	34,165,777	90,835,451
Iron, pig ....do....	376,551	([1] [3])	266,622	([1] [3])
Lime ....short tons..	([1])	([1])	([1])	([1])
Manganiferous ore ....long tons..	1,009,841	2,531,072	698,244	1,812,171
Mineral waters ....gallons sold..	([4])	([4])	([4])	([4])
Pebbles for grinding ....short tons..	([1])	([1])	([1])	([1])
Sand and gravel ....do....	4,990,256	2,412,776	4,590,790	2,274,293
Sand-lime brick ....thousands..	([1] [2])	([1] [2])	([1] [2])	([1] [2])
Stone ....short tons..	517,720	4,460,383	562,130	3,923,372
Miscellaneous [5]	....	9,872,661	....	8,115,789
Total value, eliminating duplications	....	136,349,610	....	103,931,377

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Mississippi in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] $1,189,142		[1] $613,350
Clay, raw ... short tons	990	[2] 1,500		
Mineral waters ... gallons sold	(3)	(3)	(3)	(3)
Natural gas ... M cubic feet	90,000	32,000	179,000	86,000
Sand and gravel ... short tons	2,766,036	1,277,746	2,001,272	1,050,579
Stone ... do	(4)	(4)	22,190	24,692
Miscellaneous		73,728		
Total value, eliminating duplications		2,572,616		1,774,621

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value not included in total value for State.
[3] No canvass.
[4] Value included under "Miscellaneous."

Mineral production of Missouri in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Barite ... short tons	118,679	$880,319	132,640	$938,812
Briquets, fuel ... do	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	7,984,337	11,557,905	8,030,528	11,470,751
Chats ... short tons	2,585,200	494,800	1,433,284	355,821
Clay products		[3] 14,994,548		[3] 12,517,707
Clay, raw ... short tons	497,699	[2] 1,797,448	412,827	[2] 1,275,787
Coal ... do	4,030,311	9,778,000	3,853,150	8,967,000
Coke ... do	(1 2)	(1 2)	(1 2)	(1 2)
Copper ... pounds	2,240	394	176,600	22,958
Iron ore ... long tons	171,456	661,055	132,749	508,354
Lead ... short tons	198,469	25,007,094	199,632	19,963,200
Lime ... do	316,579	2,319,886	265,771	1,861,105
Mineral paints, zinc and lead pigments ... do	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	324,000	164,000	1,064,000	326,000
Ores (crude), etc.:				
Lead ... short tons	6,442,600	(5)	6,694,800	(5)
Lead-zinc ... do	118,200	(5)	30,900	(5)
Zinc ... do	307,200	(5)	284,400	(5)
Sand and gravel ... do	5,775,729	4,291,164	5,956,766	4,776,078
Sand and sandstone (finely ground) ... do	(1)	(1)	2,222	14,553
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silver ... troy ounces	181,638	96,813	170,210	65,531
Stone ... short tons	4,397,800	7,085,323	[6] 3,910,060	[6] 6,007,531
Tripoli ... do	(1)	(1)	(1)	(1)
Zinc ... do	11,017	1,454,244	10,811	1,037,856
Miscellaneous [7]		3,798,722		3,115,439
Total value, eliminating duplications		78,948,484		69,074,500

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Montana in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Arsenious oxide short tons	9,502	$550,750	12,680	$732,886
Asbestos do	(1)	(1)		
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] 353,219		[2] 295,513
Clay, raw short tons	19,120	[3] 23,945	7,234	[3] 11,053
Coal do	3,407,526	7,561,000	3,022,004	6,043,000
Copper pounds	297,725,973	52,399,771	196,187,523	25,504,378
Ferro-alloys long tons	(1 3)	(1 3)		
Gems and precious stones		(4)		(4)
Gold troy ounces	54,758	1,131,949	43,489	899,001
Gypsum short tons	(1)	(1)	(1)	(1)
Lead do	19,607	2,470,464	10,653	1,065,302
Lime do	(1)	(1)	(1)	(1)
Manganese ore long tons	42,327	(1)	35,605	899,065
Manganiferous ore do	15,665	(1)	11,875	(1)
Marl, calcareous short tons	(1)	(1)	(1)	(1)
Micaceous minerals (vermiculite) do	(1)	(1)	(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Natural gas M cubic feet	9,659,000	2,377,000	10,060,000	2,990,000
Ores (crude), etc.:				
Copper short tons	3,802,976	(5)	2,238,997	(5)
Copper-lead and copper-lead-zinc do	51,725	(5)	330	(5)
Dry and siliceous (gold and silver) do	102,268	(5)	95,548	(5)
Lead do	15,436	(5)	23,642	(5)
Lead-zinc do	320,069	(5)	168,864	(5)
Zinc do	430,971	(5)	159,288	(5)
Petroleum barrels	3,980,000	7,260,000	3,349,000	5,420,000
Phosphate rock long tons	40	400	6,005	27,457
Sand and gravel short tons	2,446,422	667,827	1,523,516	471,555
Silver troy ounces	12,716,977	6,778,149	7,052,889	2,715,362
Stone short tons	194,320	242,412	[6] 592,810	[6] 284,658
Sulphuric acid [7] do	(1 3)	(1 3)	(1 3)	(1 3)
Tungsten ore (60 per cent concentrates) do			31	(1)
Zinc do	68,176	8,999,214	26,421	2,536,373
Miscellaneous [8]		3,515,776		1,545,108
Total value, eliminating duplications		93,842,135		50,995,123

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] From copper smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Nebraska in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[2] [3] $914,304		[2] $496,714
Clay, raw short tons	17,009	[4] 19,874	13,144	[4] 14,526
Mineral waters gallons sold	(5)	(5)	(5)	(5)
Pumice short tons	(1)	(1)	(1)	(1)
Sand and gravel do	3,370,513	1,857,065	3,443,715	1,731,230
Stone do	178,200	335,789	103,120	188,674
Miscellaneous [6]		1,737,384		2,545,394
Total value, eliminating duplications		4,844,542		4,962,012

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Exclusive of pottery, value for which is included under "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Includes minerals indicated by "1" and "3" above.

Mineral production of Nevada in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Barite short tons	818	$6,384	2,647	$19,457
Clay products	----	(1 2)	----	(1 2)
Clay, raw short tons	8,354	[3] 42,795	1,534	[3] 8,294
Coal do	(1)	(1)	----	----
Copper pounds	140,138,809	24,664,430	109,203,512	14,196,457
Diatomite short tons	540	12,097	779	20,747
Fluorspar do	1,357	(1)	974	(1)
Fuller's earth do	38,381	346,702	(1)	(1)
Gems and precious stones	----	(4)	----	(4)
Gold troy ounces	163,711	3,384,211	149,064	3,081,436
Graphite, amorphous short tons	(1)	(1)	(1)	(1)
Gypsum do	225,514	1,290,854	165,279	976,650
Lead do	9,846	1,240,632	11,529	1,152,919
Lime do	(1)	(1)	(1)	(1)
Magnesium hydrate (natural) (brucite) short tons	43	774	----	----
Manganese ore long tons	----	----	1,489	17,617
Manganiferous ore do	2,407	21,462	3,363	(1)
Marl, calcareous short tons	----	----	(1)	(1)
Mercury flasks (76 pounds)	4,764	581,899	3,282	377,460
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Copper short tons	6,572,404	(5)	4,015,426	(5)
Copper-lead do	56,644	(5)	30,171	(5)
Dry and siliceous (gold and silver) do	537,664	(5)	543,049	(5)
Lead do	74,839	(5)	10,413	(5)
Lead-zinc do	113,772	(5)	157,961	(5)
Zinc do	177	(5)	158	(5)
Potassium salts do	----	----	(1)	(1)
Salt do	(1)	(1)	(1)	(1)
Sand and gravel do	1,403,255	605,079	489,726	184,691
Silica (quartz) do	346	2,358	----	----
Silver troy ounces	4,923,526	2,624,239	4,219,832	1,624,635
Sodium sulphate from natural sources short tons	(1)	(1)	(1)	(1)
Stone do	33,400	51,805	30,120	46,850
Sulphur long tons	755	(1)	----	----
Talc short tons	----	----	50	600
Tungsten ore (60 per cent concentrates) short tons	(1)	(1)	(1)	(1)
Zinc do	8,460	1,116,725	14,584	1,400,070
Miscellaneous [6]	----	826,092	----	975,786
Total value, eliminating duplications	----	36,775,743	----	24,075,375

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

Mineral production of New Hampshire in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] $900, 388		[1] $928, 138
Diatomite short tons	10	650		
Feldspar (crude) long tons	30, 964	231, 810	16, 517	132, 342
Garnet, abrasive short tons	(2)	(2)	(2)	(2)
Mica:				
Scrap do	1, 657	35, 977	449	8, 743
Sheet pounds	984, 778	82, 657	673, 064	53, 304
Millstones				2, 325
Mineral waters gallons sold	(3)	(3)	(3)	(3)
Sand and gravel short tons	1, 976, 781	1, 223, 371	939, 767	556, 808
Silica (quartz) do	(2)	(2)	132	396
Stone do	[4] 135, 640	[4] 1, 153, 465	150, 800	1, 540, 591
Miscellaneous		97, 633		114, 522
Total value, eliminating duplications		3, 725, 951		3, 337, 169

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] No canvass.
[4] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

Mineral production of New Jersey in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[3] $39, 417, 968		[3] $29, 098, 326
Clay, raw short tons	244, 258	[2] 1, 023, 803	170, 286	[2] 713, 136
Coke do	897, 530	(1 2)	918, 814	(1 2)
Ferro-alloys long tons	(1 2)	(1 2)	(1 2)	(1 2)
Graphite, artificial pounds	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore:				
Sold to furnaces long tons	285, 115	1, 157, 848	391, 528	1, 632, 827
Sold for paint do	(1)	(1)		
Iron, pig do	204	(1 2)	405	(1 2)
Lime short tons	1, 644	15, 618	(1)	(1)
Manganiferous residuum long tons	168, 363	(1)	113, 060	(1)
Marl, greensand short tons	13, 016	253, 180	12, 761	221, 211
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ore (zinc) short tons	789, 552	(5)	690, 348	(5)
Peat do	(4)	(4)	(4)	(4)
Sand and gravel do	6, 721, 498	5, 585, 285	5, 969, 479	5, 009, 866
Sand and sandstone (finely ground) do	(1)	(1)	(1)	(1)
Sand-lime brick thousands	(1 3)	(1 3)	(1 3)	(1 3)
Slate		(1)		(1)
Stone short tons	2, 740, 410	4, 219, 553	2, 702, 420	3, 907, 281
Talc do	(1)	(1)	(1)	(1)
Zinc do	103, 740	(1)	97, 626	(1)
Miscellaneous [6]		27, 901, 102		24, 141, 743
Total value, eliminating duplications		71, 891, 861		57, 206, 357

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metal.
[6] Includes minerals indicated by "1" above.

Mineral production of New Mexico in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		[1] $155, 138		[1] $181, 117
Clay, raw ... short tons	10, 347	[2] 20, 021	6, 400	[2] 10, 923
Coal ... do	2, 622, 769	8, 314, 000	1, 969, 433	6, 017, 000
Columbite ... pounds			1, 000	(3)
Copper ... do	97, 717, 262	17, 198, 238	65, 150, 000	8, 469, 500
Fluorspar ... short tons	2, 438	(3)	2, 312	(3)
Gems and precious stones		(4)		(4)
Gold ... troy ounces	35, 176	727, 162	32, 370	669, 156
Gypsum ... short tons	(3)	(3)		
Iron ore ... long tons	171, 585	(3)	173, 432	(3)
Lead ... short tons	11, 130	1, 402, 431	10, 378	1, 037, 845
Lime ... do	(3)	(3)	2, 369	21, 446
Lithium minerals ... do	(3)	(3)	(3)	(3)
Manganese ore ... long tons	2, 969	50, 173	2, 574	34, 884
Manganiferous ore ... do	67, 558	(3)	14, 427	41, 116
Mica:				
Scrap ... short tons	420	8, 210	768	12, 004
Sheet ... pounds	4, 550	1, 368	(3)	(3)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Molybdenum ... pounds	(3)	(3)	(3)	(3)
Natural gas ... M cubic feet	3, 054, 000	536, 000	9, 497, 000	1, 273, 000
Natural gasoline ... gallons	1, 077, 000	71, 000	3, 663, 000	169, 000
Ores (crude), etc.:				
Copper ... short tons	4, 114, 187	(5)	2, 636, 107	(5)
Copper-lead ... do	2, 367	(5)		
Dry and siliceous (gold and silver) ... do	4, 858	(5)	28, 933	(5)
Lead ... do	16, 265	(5)	5, 726	(5)
Lead-zinc ... do	306, 042	(5)	211, 562	(5)
Zinc ... do	63, 088	(5)	89, 113	(5)
Petroleum ... barrels	1, 830, 000	2, 170, 000	10, 189, 000	9, 180, 000
Salt ... short tons	(3)	(3)	(3)	(3)
Sand and gravel ... do	337, 768	177, 368	314, 667	282, 360
Silver ... troy ounces	1, 121, 546	597, 784	1, 107, 335	426, 324
Stone ... short tons	[6] 20, 930	[6] 21, 193	213, 340	161, 944
Zinc ... do	34, 455	4, 548, 060	32, 765	3, 145, 392
Miscellaneous [7]		1, 149, 496		728, 175
Total value, eliminating duplications		37, 127, 621		31, 850, 263

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value not included in total value for State.
[3] Value included under "Miscellaneous.".
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of limestone and sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "3" and "6" above.

Mineral production of New York in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Aluminum ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	[3] 10, 742, 992	[3] $15, 597, 868	[3] 10, 256, 086	[3] $15, 380, 703
Clay products		[4] 17, 661, 711		[4] 14, 837, 430
Clay, raw ... short tons	8, 155	[2] 45, 553	5, 191	[2] 33, 458
Coke ... do	4, 299, 470	[2] 25, 305, 915	3, 849, 563	[2] 24, 657, 090
Diatomite ... do	186	13, 249	208	14, 767
Emery ... do	804	8, 922	555	5, 996
Feldspar (crude) ... long tons	12, 696	103, 531	5, 556	37, 790
Ferro-alloys ... do	214, 826	[2] 19, 729, 001	143, 269	[2] 11, 526, 887
Garnet, abrasive ... short tons	(1)	(1)	(1)	(1)
Graphite, artificial ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum ... short tons	1, 284, 338	8, 339, 852	912, 070	7, 059, 108
Iron ore:				
Sold to furnaces ... long tons	875, 564	3, 941, 985	755, 074	3, 663, 155
Sold for paint ... do	(1)	(1)	(1)	(1)
Iron, pig ... do	2, 626, 771	[2] 46, 960, 186	1, 638, 323	[2] 29, 160, 894

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of natural cement, value for which is included under "Miscellaneous."
[4] Figures obtained through cooperation with Bureau of the Census.

Mineral production of New York in 1929 and 1930—Continued

Product	1929		1930	
	Quantity	Value	Quantity	Value
Lead .... short tons			(1)	(1)
Lime .... do	104, 614	$906, 021	83, 078	$702, 475
Millstones		18, 147		6, 577
Mineral waters .... gallons sold	(5)	(5)	(5)	(5)
Natural gas .... M cubic feet	8, 387, 000	5, 538, 000	9, 624, 000	6, 433, 000
Natural gasoline .... gallons	264, 000	22, 000	208, 000	19, 000
Ores (crude), etc.:				
Lead-zinc .... short tons			131, 245	(6)
Zinc .... do	149, 183	(6)	139, 356	(6)
Peat .... do	(5)	(5)	(5)	(5)
Petroleum .... barrels	3, 377, 000	13, 170, 000	3, 647, 000	9, 850, 000
Pyrites .... long tons			15, 474	(1)
Salt .... short tons	2, 194, 590	6, 470, 051	2, 009, 280	5, 837, 103
Sand and gravel .... do	21, 061, 094	14, 919, 658	20, 865, 866	12, 710, 172
Sand-lime brick .... thousands	[4] 32, 711	[4] 327, 173	(1 4)	(1 4)
Silica (quartz) .... short tons	(1)	(1)	(1)	(1)
Slate		838, 531		438, 619
Stone .... short tons	[7] 11, 693, 640	[7] 15, 895, 914	12, 915, 190	18, 141, 668
Talc .... do	109, 543	1, 439, 272	93, 216	1, 192, 604
Zinc .... do	10, 250	1, 353, 000	22, 471	2, 157, 216
Miscellaneous [8]		32, 272, 978		30, 725, 205
Total value, eliminating duplications		109, 361, 349		99, 622, 368

[1] Value included under "Miscellaneous."
[4] Figures obtained through cooperation with Bureau of the Census.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of basalt and unclassified stone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1," "3," and "7" above.

Mineral production of North Carolina in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Aluminum .... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Asbestos .... short tons	(1)	(1)		
Clay products		[3] $3, 196, 830		[3] $1, 714, 304
Clay, raw .... short tons	17, 683	[2] 282, 682	24, 759	[2] 391, 571
Coal .... do	52, 180	177, 000	28, 500	100, 000
Copper .... pounds	(1)	(1)	(1)	(1)
Feldspar (crude) .... long tons	103, 273	598, 938	103, 163	593, 552
Gems and precious stones		(4)		(4)
Gold .... troy ounces	244	5, 054	705	14, 582
Iron ore .... long tons	30, 575	106, 411		
Lime .... short tons	(1)	(1)	(1)	(1)
Manganese ore .... long tons			60	(1)
Marl, calcareous .... short tons	3, 391	8, 475	(1)	(1)
Mica:				
Scrap .... do	3, 245	53, 855	4, 744	75, 400
Sheet .... pounds	894, 200	150, 293	749, 074	112, 451
Micaceous minerals (muscovite schist) .... short tons	(1)	(1)	(1)	(1)
Millstones		(1)		4, 250
Mineral waters .... gallons sold	(4)	(4)	(4)	(4)
Ores (crude):				
Copper .... short tons	(5)	(6)	97, 445	(6)
Dry and siliceous (gold and silver) .... do	2, 880	(6)	700	(6)
Sand and gravel .... do	1, 004, 858	1, 020, 533	800, 222	437, 555
Silica (quartz) .... do	2, 493	28, 709	2, 981	23, 838
Silver .... troy ounces	21, 106	11, 249	30, 054	11, 571
Stone .... short tons	1, 607, 670	3, 880, 113	1, 099, 960	2, 456, 887
Talc .... do	9, 439	81, 306	(1)	(1)
Tin (metallic equivalent) .... do			(1)	(1)
Miscellaneous [7]		12, 744, 026		8, 685, 060
Total value, eliminating duplications		10, 963, 896		7, 462, 450

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Bureau of Mines not at liberty to publish figures.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" above.

Mineral production of North Dakota in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel.....short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Clay products.....	.....	[3] $174, 892	.....	[3] $160, 838
Clay, raw.....short tons..	28	[2] 269	359	[2] 557
Coal.....do....	1, 862, 130	3, 157, 000	1, 700, 157	2, 768, 000
Mineral waters.....gallons sold..	(4)	(4)	(4)	(4)
Natural gas.....M cubic feet..	(1)	(1)	(1)	(1)
Sand and gravel.....short tons..	493, 411	133, 621	473, 184	127, 505
Miscellaneous [5].....	.....	169, 950	.....	63, 231
Total value, eliminating duplications.....	.....	3, 465, 563	.....	3, 056, 493

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Ohio in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Bromine.....pounds..	(1)	(1)	(1)	(1)
Calcium chloride.....short tons..	(1)	(1)	(1)	(1)
Cement.....barrels..	[2] 9, 144, 085	[2] $13, 427, 778	[2] 8, 185, 077	[2] $11, 956, 038
Clay products.....	.....	[3] 81, 797, 495	.....	[3] 61, 449, 555
Clay, raw.....short tons..	414, 486	[4] 979, 461	419, 217	[4] 811, 028
Coal.....do....	23, 689, 477	35, 733, 000	22, 551, 978	31, 643, 000
Coke.....do....	[5] 8, 521, 132	[4 5] 35, 202, 383	6, 163, 324	[4] 26, 706, 788
Ferro-alloys.....long tons..	85, 237	[4] 3, 060, 184	78, 746	[4] 2, 365, 006
Grindstones and pulpstones.....short tons..	19, 944	660, 195	12, 114	358, 875
Gypsum.....do....	374, 008	3, 301, 440	255, 337	3, 094, 495
Iron, pig.....long tons..	9, 446, 984	[4] 163, 480, 003	6, 541, 212	[4] 111, 529, 209
Lime.....short tons..	962, 415	7, 935, 656	736, 305	5, 711, 855
Marl, calcareous.....do....	(1)	(1)	(1)	(1)
Mineral paints, zinc and lead pigments..do....	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters.....gallons sold..	(6)	(6)	(6)	(6)
Natural gas.....M cubic feet..	57, 936, 000	32, 890, 000	63, 394, 000	36, 491, 000
Natural gasoline.....gallons..	11, 166, 000	923, 000	8, 937, 000	605, 000
Petroleum.....barrels..	6, 743, 000	15, 770, 000	6, 486, 000	11, 960, 000
Rubbing stones, scythestones, and whetstones .....short tons..	279	40, 014	229	29, 986
Salt.....do....	1, 449, 360	3, 199, 903	1, 311, 440	3, 015, 206
Sand and gravel.....do....	14, 250, 141	9, 182, 862	12, 679, 854	8, 173, 741
Sand and sandstone (finely ground).....do....	(1)	(1)	(1)	(1)
Sand-lime brick.....thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Stone.....short tons..	14, 771, 030	14, 957, 234	13, 008, 030	12, 329, 536
Sulphuric acid [7].....do....	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [8].....	.....	4, 575, 307	.....	3, 599, 933
Total value, eliminating duplications.....	.....	220, 061, 343	.....	186, 971, 555

[1] Value included under "Miscellaneous."
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] Exclusive of beehive coke, value for which is included under "Miscellaneous," but not in total value for State.
[6] No canvass.
[7] From zinc smelting.
[8] Includes minerals indicated by "1," "2," and "5" above.

Mineral production of Oklahoma in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asphalt (native)...short tons..	(1)	(1)	(1)	(1)
Briquets, fuel...do...	(1 2)	(1 2)	(1 2)	(1 2)
Cement...barrels..	(1)	(1)	(1)	(1)
Chats...short tons..	240, 400	$46, 800	330, 000	$82, 500
Clay products...	...	[3] 1, 892, 919	...	[3] 941, 365
Clay, raw...short tons..	31	[2] 153	(1 2)	(1 2)
Coal...do...	3, 774, 080	11, 481, 000	2, 793, 954	7, 768, 000
Gypsum...do...	369, 433	2, 255, 374	(1)	(1)
Lead...do...	46, 513	5, 860, 638	23, 052	2, 305, 200
Lime...do...	(1)	(1)	(1)	(1)
Mineral waters...gallons sold..	(4)	(4)	(4)	(4)
Natural gas...M cubic feet..	357, 893, 000	53, 528, 000	348, 116, 000	47, 632, 000
Natural gasoline...gallons..	676, 030, 000	42, 766, 000	591, 194, 000	29, 148, 000
Ores (crude), etc.:				
Lead...short tons..	60, 400	(5)	...	...
Lead-zinc...do...	6, 313, 700	(5)	4, 125, 400	(5)
Zinc...do...	2, 950, 500	(5)	3, 088, 200	(5)
Petroleum...barrels..	255, 004, 000	364, 650, 000	216, 486, 000	279, 250, 000
Salt...short tons..	(1)	(1)	(1)	(1)
Sand and gravel...do...	2, 904, 897	1, 612, 755	2, 553, 070	1, 446, 137
Stone...do...	2, 096, 080	1, 728, 938	[6] 1, 958, 120	[6] 1, 631, 477
Sulphuric acid [7]...do...	(1 2)	(1 2)	(1 2)	(1 2)
Tripoli...do...	(1)	(1)	(1)	(1)
Zinc...do...	192, 042	25, 349, 544	136, 153	13, 070, 688
Miscellaneous [8]...	...	5, 929, 317	...	7, 363, 290
Total value, eliminating duplications...	...	516, 685, 232	...	390, 170, 991

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Oregon in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel...short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Cement...barrels..	(1)	(1)	(1)	(1)
Clay products...	...	[3] $709, 494	...	[3] $393, 955
Clay, raw...short tons..	1, 319	[2] 2, 236	41	[2] 154
Coal...do...	(1)	(1)	(1)	(1)
Copper...pounds..	655, 746	115, 411	176, 300	22, 919
Diatomite...short tons..	(1)	(1)	(1)	(1)
Gems and precious stones...	...	(4)	...	(4)
Gold...troy ounces..	17, 092	353, 323	14, 401	297, 702
Lead...short tons..	10	1, 271	5	456
Lime...do...	2, 486	40, 406	1, 741	25, 196
Mercury...flasks (76 pounds)..	3, 657	446, 684	2, 919	335, 711
Mineral waters...gallons sold..	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Copper...short tons..	3, 836	(5)	1, 033	(5)
Dry and siliceous (gold and silver)...do...	6, 673	(5)	7, 918	(5)
Lead-zinc...do...	...	...	43	(5)
Platinum and allied metals...troy ounces..	12	870	8	487
Pumice...short tons..	109	3, 144	...	...
Sand and gravel...do...	2, 257, 338	1, 508, 787	2, 824, 519	1, 644, 243
Silver...troy ounces..	30, 009	15, 995	9, 000	3, 465
Stone...short tons..	[6] 1, 951, 890	[6] 1, 905, 747	1, 685, 740	1, 708, 956
Zinc...do...	...	...	6	601
Miscellaneous [7]...	...	2, 491, 653	...	2, 453, 926
Total value, eliminating duplications...	...	6, 876, 703	...	6, 169, 898

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of granite, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Pennsylvania in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel .... short tons	159,648	[1] $992,471	133,922	[1] $833,104
Cement .... barrels	[2] 39,309,662	[2] 55,600,953	[2] 37,968,647	[2] 52,712,176
Clay products		[3] 49,674,492		[3] 38,336,710
Clay, raw .... short tons	1,054,784	[1] 2,611,532	801,553	[1] 1,965,186
Coal:				
Anthracite .... do	73,828,195	385,642,751	69,384,837	354,574,191
Bituminous .... do	143,516,241	258,607,000	124,462,787	213,584,000
Coke .... do	[4] 14,489,283	[1 4] 55,088,803	14,540,579	[1] 54,098,236
Copper [5] .... pounds	3,454,170	607,934	2,859,675	371,758
Feldspar (crude) .... long tons	(6)	(6)	(6)	(6)
Ferro-alloys .... do	428,629	[1] 42,361,076	340,475	[1] 29,627,740
Gems and precious stones		(7)		(7)
Gold [5] .... troy ounces	836	17,282	630	13,023
Iron ore:				
Sold to furnaces .... long tons	1,151,130	2,382,839	894,039	1,850,661
Sold for paint .... do	1,775	(6)	(6)	(6)
Iron, pig .... do	14,058,194	[1] 257,154,601	9,734,591	[1] 176,521,843
Lime .... short tons	782,915	5,896,752	633,520	4,661,670
Micaceous minerals (vermiculite) .... do	(6)	(6)		
Mineral paints, zinc and lead pigments .... do	(1 6)	(1 6)	(1 6)	(1 6)
Mineral waters .... gallons sold	(7)	(7)	(7)	(7)
Natural gas .... M cubic feet	101,951,000	48,821,000	88,706,000	44,521,000
Natural gasoline .... gallons	18,411,000	1,676,000	16,713,000	1,229,000
Peat .... short tons	(7)	(7)	(7)	(7)
Petroleum .... barrels	11,820,000	44,800,000	12,803,000	33,410,000
Sand and gravel .... short tons	12,674,320	13,658,328	11,012,512	11,107,825
Sand and sandstone (finely ground) .... do	(6)	(6)	(6)	(6)
Sand-lime brick .... thousands			(3 6)	(3 6)
Silver [5] .... troy ounces	5,972	3,183	5,762	2,218
Slate		4,798,200		3,634,258
Stone .... short tons	18,169,270	19,956,410	15,137,560	17,822,706
Sulphuric acid (60° Baumé) [8] .... do	141,634	[1] 1,363,935	141,506	[1] 1,362,703
Talc .... do	(6)	(6)	(6)	(6)
Tripoli (rottenstone) .... do	(6)	(6)	(6)	(6)
Miscellaneous [9]		30,536,197		8,963,050
Total value, eliminating duplications		892,913,833		778,523,421

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[1] Value not included in total value for State.
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Exclusive of beehive coke, value for which is included under "Miscellaneous," but not in total value for State.
[5] Copper, gold, and silver were recovered from pyritiferous magnetite. The quantity of such ore was 1,289,266 short tons in 1929 and 1,001,324 short tons in 1930; it is included in the figures shown for iron ore.
[6] Value included under "Miscellaneous."
[7] No canvass.
[8] From zinc smelting.
[9] Includes minerals indicated by "2," "4," and "6" above.

Mineral production of Rhode Island in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Clay products		(1 2)		(1 2)
Coke .... short tons	(1 3)	(1 3)	(1 3)	(1 3)
Graphite, amorphous .... do	(1)	(1)	(1)	(1)
Lime .... do	1,885	$24,464	2,638	$34,986
Mineral waters .... gallons sold	(4)	(4)	(4)	(4)
Sand and gravel .... short tons	301,533	154,390	728,390	283,174
Stone .... do	141,290	590,627	201,110	757,306
Miscellaneous [5]		1,321,649		1,592,385
Total value, eliminating duplications		939,602		1,209,227

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[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of South Carolina in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Barite……short tons	(1)	(1)	(1)	(1)
Clay products……		[2] $1, 252, 817		[2] $792, 761
Clay, raw……short tons	103, 103	[3] 896, 472	92, 116	[3] 747, 620
Marl, calcareous……do	3, 472	9, 548	(1)	(1)
Mica:				
Scrap……do			(1)	(1)
Sheet……pounds			(1)	(1)
Mineral waters……gallons sold	(4)	(4)	(4)	(4)
Sand and gravel……short tons	1, 068, 005	602, 432	744, 378	475, 009
Stone……do	1, 067, 060	1, 702, 575	1, 391, 910	2, 021, 213
Miscellaneous……		24, 740		52, 068
Total value, eliminating duplications……		3, 592, 112		3, 341, 051

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[1] Value included under "Miscellaneous."

[2] Figures obtained through cooperation with Bureau of the Census.

[3] Value not included in total value for State.

[4] No canvass.

Mineral production of South Dakota in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement……barrels	(1)	(1)	(1)	(1)
Clay products……		(1 2)		(1 2)
Clay, raw……short tons	1, 275	[3] $5, 100	960	[3] $3, 840
Coal……do	12, 854	38, 000	12, 510	31, 000
Columbite……pounds	22, 117	17, 261	4, 100	(1)
Feldspar (crude)……long tons	(1)	(1)	(1)	(1)
Gems and precious stones……		(4)		(4)
Gold……troy ounces	316, 837	6, 549, 599	407, 221	8, 418, 008
Gypsum……short tons	(1)	(1)	(1)	(1)
Lime……do	(1)	(1)	(1)	(1)
Lithium minerals……do	(1)	(1)	(1)	(1)
Mica:				
Scrap……do	(1)	(1)	(1)	(1)
Sheet……pounds			(1)	(1)
Mineral waters……gallons sold	(4)	(4)	(4)	(4)
Natural gas……M cubic feet	99, 000	40, 000	98, 000	32, 000
Ores (crude), etc.:				
Dry and siliceous (gold and silver)……short tons	1, 463, 159	(5)	1, 365, 156	(5)
Pumice……do			80	1, 600
Sand and gravel……do	2, 729, 271	578, 204	2, 419, 441	931, 814
Sand-lime brick……thousands	(1 2)	(1 2)	(1 2)	(1 2)
Silver……troy ounces	85, 182	45, 402	105, 236	40, 516
Stone……short tons	250, 440	635, 890	166, 020	666, 201
Tin (metallic equivalent)……do	(6)	200	(1)	(1)
Tungsten ore (60 per cent concentrates)……do	5	(1)		
Miscellaneous [7]……		1, 009, 788		954, 669
Total value, eliminating duplications……		8, 914, 344		11, 075, 808

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[1] Value included under "Miscellaneous."

[2] Figures obtained through cooperation with Bureau of the Census.

[3] Value not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] 500 pounds.

[7] Includes minerals indicated by "1" above.

Mineral production of Tennessee in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Aluminum ... pounds	(1 2)	(1 2)	(1 2)	(1 2)
Barite ... short tons	26, 140	$181, 725	17, 006	$111, 981
Cement ... barrels	4, 537, 601	5, 576, 235	3, 822, 598	5, 315, 693
Clay products	----	[3] 3, 695, 837	----	[3] 1, 915, 224
Clay, raw ... short tons	110, 590	[2] 585, 061	69, 700	[2] 365, 659
Coal ... do	5, 405, 464	9, 122, 000	5, 130, 428	8, 417, 000
Coke ... do	209, 166	[2] 1, 086, 374	125, 912	[2] 523, 813
Copper ... pounds	(1)	(1)	(1)	(1)
Ferro-alloys ... long tons	(1 2)	(1 2)	(1 2)	(1 2)
Gold ... troy ounces	565	11, 680	696	14, 388
Iron ore:				
Sold to furnaces ... long tons	101, 796	234, 827	27, 384	76, 089
Sold for paint ... do	375	(1)	(1)	(1)
Iron, pig ... do	104, 985	[2] 1, 938, 238	42, 197	[2] 828, 716
Iron sinter from copper sulphide ore ... do	121, 851	(1)	(1)	(1)
Lead ... short tons	----	----	(1)	(1)
Lime ... do	172, 936	1, 036, 405	147, 648	855, 452
Manganese ore ... long tons	523	12, 425	508	(1)
Manganiferous ore ... do	241	1, 810	113	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	25, 000	10, 700	24, 000	9, 000
Ores (crude), etc.:				
Copper ... short tons	825, 300	(5)	789, 495	(5)
Lead-zinc ... do	----	----	10, 000	(5)
Zinc ... do	682, 680	(5)	699, 760	(5)
Petroleum ... barrels	19, 000	30, 000	21, 000	26, 000
Phosphate rock ... long tons	633, 939	3, 097, 104	611, 045	2, 938, 525
Pyrites ... do	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	3, 089, 500	2, 086, 535	2, 182, 958	1, 436, 034
Silver ... troy ounces	81, 281	43, 323	83, 640	32, 201
Stone ... short tons	[6] 2, 419, 070	[6] 8, 043, 006	1, 783, 530	5, 186, 653
Sulphuric acid [7] ... do	(1 2)	(1 2)	(1 2)	(1 2)
Tripoli ... do	(1)	(1)	(1)	(1)
Zinc ... do	(1)	(1)	(1)	(1)
Miscellaneous [8]	----	24, 092, 661	----	25, 774, 979
Total value, eliminating duplications	----	40, 719, 706	----	32, 499, 380

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] From copper smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Texas in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asphalt (native) ... short tons	320, 931	$946, 003	270, 138	$825, 460
Briquets, fuel ... do	----	----	(1 2)	(1 2)
Cement ... barrels	7, 083, 572	11, 805, 779	6, 792, 346	10, 782, 444
Clay products	----	[3] 6, 010, 179	----	[3] 4, 007, 858
Clay, raw ... short tons	3, 178	[2] 19, 390	14, 774	[2] 105, 971
Coal ... do	1, 100, 668	1, 600, 000	833, 872	1, 307, 000
Copper ... pounds	341, 000	60, 016	143, 100	18, 603
Fuller's earth ... short tons	34, 249	322, 215	45, 503	443, 477
Gems and precious stones	----	(4)	----	(4)
Gold ... troy ounces	1, 279	26, 439	176	3, 648
Graphite, crystalline ... pounds	(1)	(1)	----	----
Gypsum ... short tons	520, 519	3, 440, 287	359, 315	3, 521, 743
Lead ... do	425	53, 530	198	19, 841
Lime ... do	97, 332	838, 470	74, 081	639, 821
Manganese ore ... long tons	42	(1)	247	4, 147
Marl, greensand ... short tons	250	2, 500	----	----
Mercury ... flasks (76 pounds)	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	464, 928, 000	67, 474, 000	517, 880, 000	71, 873, 000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.

Mineral production of Texas in 1929 and 1930—Continued

Product	1929		1930	
	Quantity	Value	Quantity	Value
Natural gasoline ..... gallons	419,485,000	$26,561,000	491,299,000	$23,596,000
Ores (crude), etc.:				
Copper ..... short tons	1,456	(1)	734	(5)
Copper-lead ..... do	20	(1)	......	......
Dry and siliceous (gold and silver) ..... do	62,396	(1)	29,677	(5)
Lead ..... do			736	(5)
Petroleum ..... barrels	296,876,000	322,520,000	290,457,000	288,410,000
Salt ..... short tons	(1)	(1)	(1)	(1)
Sand and gravel ..... do	9,409,295	5,765,943	8,803,929	5,567,127
Sand-lime brick ..... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silver ..... troy ounces	1,020,516	543,935	389,239	149,857
Stone ..... short tons	[6] 3,647,150	[6] 2,948,865	[6] 2,807,960	[6] 2,496,136
Sulphur ..... long tons	2,435,483	43,811,000	1,989,917	35,800,000
Miscellaneous [7]	......	1,089,339	......	951,323
Total value, eliminating duplications	......	495,819,500	......	450,373,151

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[1] Value included under "Miscellaneous."

[3] Figures obtained through cooperation with Bureau of the Census.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Exclusive of basalt, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Utah in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Arsenious oxide ..... short tons	2,090	$120,515	2,297	$132,738
Asphalt (native) ..... do	65,541	1,479,832	47,635	965,587
Cement ..... barrels	(1)	(1)	(1)	(1)
Clay products	......	[2 3] 1,028,342	......	[2] 732,608
Clay, raw ..... short tons	24,426	[4] 243,233	35,092	[4] 385,462
Coal ..... do	5,160,521	12,725,000	4,257,541	10,515,000
Coke ..... do	281,994	(1 4)	231,869	(1 4)
Copper ..... pounds	318,282,523	56,017,724	180,526,423	23,468,435
Gems and precious stones	......	(5)	......	(5)
Gold ..... troy ounces	240,420	4,969,915	208,455	4,309,148
Gypsum ..... short tons	(1)	(1)	26,694	185,148
Iron ore:				
Sold to furnaces ..... long tons	324,885	(1)	278,918	(1)
Sold for paint ..... do	100	(1)	200	(1)
Iron, pig ..... do	(1 4)	(1 4)	(1 4)	(1 4)
Lead ..... short tons	149,377	18,821,529	115,495	11,549,489
Lime ..... do	46,581	365,055	27,522	236,607
Manganese ore ..... long tons	88	(1)	......	......
Manganiferous ore ..... do	5,942	(1)	10,972	91,742
Marl, calcareous ..... short tons	(1)	(1)	......	......
Natural gas ..... M cubic feet	693,000	205,000	393,000	123,000
Ores (crude), etc.:				
Copper ..... short tons	17,895,332	(6)	9,696,962	(6)
Copper-lead ..... do	44,219	(6)	52,757	(6)
Dry and siliceous (gold and silver) ..... do	255,192	(6)	223,010	(6)
Lead ..... do	374,802	(6)	237,240	(6)
Lead-zinc ..... do	1,262,387	(6)	831,872	(6)
Zinc ..... do	43	(6)	......	......
Petroleum ..... barrels	(1)	(1)	(1)	(1)
Potassium salts ..... short tons	(1)	(1)	......	......
Salt ..... do	84,940	202,676	85,240	188,983
Sand and gravel ..... do	1,588,305	722,971	1,201,849	613,951
Sand-lime brick ..... thousands	(1 2)	(1 2)	......	......
Silver ..... troy ounces	17,592,396	9,376,747	13,129,421	5,054,827
Stone ..... short tons	[7] 206,590	[7] 249,592	633,630	395,174
Sulphur ..... long tons	1,000	(1)	......	......
Sulphuric acid [8] ..... short tons	(1 4)	(1 4)	(1 4)	(1 4)
Uranium and vanadium ores ..... do	(1)	(1)	(1)	(1)
Zinc ..... do	51,510	6,799,286	44,495	4,271,565
Miscellaneous [9]	......	7,189,644	......	5,145,403
Total value, eliminating duplications	......	115,131,131	......	64,224,307

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[1] Value included under "Miscellaneous."

[2] Figures obtained through cooperation with Bureau of the Census.

[3] Exclusive of pottery, value for which is included under "Miscellaneous."

[4] Value not included in total value for State.

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metal

[7] Exclusive of marble, value for which is included under "Miscellaneous."

[8] From copper smelting.

[9] Includes minerals indicated by "1," "3," and "7" above.

Mineral production of Vermont in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos short tons	1,049	$47,799	2,958	$94,130
Clay products		(1 2)		(1 2)
Clay, raw short tons	2,639	[3] 16,673	12,221	[3] 66,490
Copper pounds	(2)	(2)	(2)	(2)
Lime short tons	53,128	505,246	45,963	406,921
Mineral waters gallons sold	(4)	(4)	(4)	(4)
Ore (copper) short tons	31,529	(5)	28,418	(5)
Sand and gravel do	170,301	58,879	313,060	67,369
Scythestones do	(2)	(2)	(2)	(2)
Silver troy ounces	3,284	1,750	4,108	1,582
Slate		3,704,894		2,463,241
Stone short tons	[6] 367,240	[6] 9,435,680	286,490	7,983,160
Talc do	60,469	546,658	45,881	399,548
Miscellaneous [7]		301,683		221,442
Total value, eliminating duplications		14,602,589		11,637,393

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "2" and "6" above.

Mineral production of Virginia in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Barite short tons	(1)	(1)	10,250	$73,168
Briquets, fuel do	24,315	[2] $152,940	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay products		[3 4] 2,948,309		[3] 2,380,100
Clay, raw short tons	10,959	[2] 88,513	7,358	[2] 50,177
Coal do	12,748,306	20,942,000	10,907,377	17,520,000
Coke do	314,859	[2] 1,283,740	219,656	[2] 846,542
Diatomite do	(1)	(1)	518	4,301
Emery do	120	1,800		
Feldspar (crude) long tons	6,677	38,628	6,760	38,048
Ferro-alloys do	(1 2)	(1 2)	(1 2)	(1 2)
Gem feldspar pounds	2,200	2,200		
Gypsum short tons	(1)	(1)	(1)	(1)
Iron ore long tons	232	631	36,178	65,528
Iron, pig do	44,512	(1 2)	50,629	(1 2)
Lead short tons	(1)	(1)	(1)	(1)
Lime do	153,170	1,061,018	146,996	960,219
Manganese ore long tons	3,051	(1)	3,853	(1)
Manganiferous ore do	80	810	193	1,560
Marl, calcareous short tons	9,554	25,702	7,889	19,410
Mica:				
Scrap do	456	10,367	(1)	(1)
Sheet pounds	(1)	(1)	(1)	(1)
Millstones		5,260		(1)
Mineral waters gallons sold	(5)	(5)	(5)	(5)
Ores (crude), etc.:				
Lead-zinc short tons	(6)	(7)	(6)	(7)
Zinc do	(6)	(7)	1,000	(7)
Pyrites long tons	(1)	(1)	(1)	(1)
Salt short tons	(1)	(1)	(1)	(1)
Sand and gravel do	1,728,590	1,165,358	1,470,380	997,227
Sand and sandstone (finely ground) do	(1)	(1)		
Silica (quartz) do	(1)	(1)		
Slate		[8] 434,628		[8] 303,335
Stone short tons	[9] 3,605,210	[9] 3,662,569	3,793,700	3,852,535
Talc and soapstone do	(1)	(1)	(1)	(1)
Titanium minerals:				
Ilmenite do	(1)	(1)	(1)	(1)
Rutile do	(1)	(1)	(1)	(1)
Zinc do	(1)	(1)	(1)	(1)
Miscellaneous [10]		14,119,388		11,370,829
Total value, eliminating duplications		39,752,683		34,602,749

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Exclusive of pottery, value for which is included under "Miscellaneous."
[5] No canvass.
[6] Bureau of Mines not at liberty to publish figures.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of granules, etc., value for which is included under "Miscellaneous."
[9] Exclusive of marble and unclassified stone, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1," "4," "8," and "9" above.

Mineral production of Washington in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Asbestos ....short tons..	....	....	(1)	(1)
Briquets, fuel ....do....	49,455	[2] $356,291	36,924	[2] $272,828
Cement ....barrels..	(1)	(1)	(1)	(1)
Clay products........	....	[3] 2,566,891	....	[3] 2,400,782
Clay, raw ....short tons..	28,404	[2] 39,133	28,784	[2] 24,647
Coal ....do....	2,521,327	8,647,000	2,301,928	7,439,000
Coke ....do....	66,723	[2] 493,827	48,473	[2] 355,323
Copper ....pounds	1,400,489	246,486	1,206,438	156,837
Diatomite ....short tons..	(1)	(1)	840	14,800
Gold ....troy ounces.	3,720	76,898	4,245	87,748
Iron ore........long tons..	5,018	(1)	....	....
Lead ....short tons..	508	63,956	576	57,629
Lime ....do....	31,598	324,683	26,913	266,131
Magnesite ....do....	(1)	(1)	(1)	(1)
Mercury ....flasks (76 pounds)..	1,397	170,637	1,079	124,095
Mineral waters........gallons sold..	(4)	(4)	(4)	(4)
Natural gas........M cubic feet..	(1)	(1)	(1)	(1)
Ores (crude), etc.:				
Copper........short tons..	34,145	(5)	28,565	(5)
Dry and siliceous (gold and silver)...do....	5,162	(5)	7,710	(5)
Lead ....do....	3,176	(5)	1,981	(5)
Lead-zinc........do....	51,044	(5)	7,200	(5)
Pulpstones........do....	(1)	(1)	(1)	(1)
Rubbing stones........do....	(1)	(1)	....	....
Sand and gravel........do....	5,391,693	2,138,019	5,307,622	2,181,012
Sand-lime brick........thousands..	....	....	(1 3)	(1 3)
Silica (quartz) ....short tons..	(1)	(1)	(1)	(1)
Silver........troy ounces..	47,182	25,148	32,816	12,634
Sodium carbonate from natural sources ....short tons..	(1)	(1)	....	....
Stone........do....	1,673,390	1,960,460	[6] 1,773,610	[6] 1,782,493
Tungsten ore (60 per cent concentrates)..do....	....	....	7	(1)
Zinc........do....	1,059	139,745	352	33,782
Miscellaneous [7]........	....	6,075,436	....	5,518,901
Total value, eliminating duplications....	....	22,435,359	....	20,075,844

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of marble, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of West Virginia in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Briquets, fuel........short tons..	(1 2)	(1 2)	102,835	[2] $512,322
Bromine........pounds..	85,790	$26,106	(1)	(1)
Calcium chloride........short tons..	4,830	49,780	(1)	(1)
Cement........barrels..	(1)	(1)	(1)	(1)
Clay products........	....	[3] 20,490,255	....	[3] 15,954,195
Clay, raw ....short tons..	60,530	[2] 99,054	46,079	[2] 68,409
Coal........do....	138,518,855	215,110,000	121,472,638	181,722,000
Coke........do....	1,928,583	[2] 5,286,427	1,901,161	[2] 5,061,759
Ferro-alloys........long tons.	(1 2)	(1 2)	(1 2)	(1 2)
Grindstones and pulpstones........short tons..	6,518	516,453	5,100	361,135
Iron, pig........long tons..	653,048	(1 2)	704,654	(1 2)
Lime........short tons..	308,600	1,865,531	228,230	1,394,075
Marl, calcareous........do....	(1)	(1)	(1)	(1)
Mineral waters........gallons sold..	(4)	(4)	(4)	(4)
Natural gas........M cubic feet..	167,333,000	73,793,000	144,180,000	66,553,000
Natural gasoline........gallons..	72,994,000	6,285,000	63,328,000	4,151,000
Petroleum........barrels..	5,574,000	20,070,000	5,071,000	11,820,000
Salt........short tons..	20,290	153,477	28,670	184,327
Sand and gravel........do....	2,667,940	2,893,542	2,695,437	2,813,284
Sand and sandstone (finely ground)........do....	(1)	(1)	(1)	(1)
Stone........do....	3,375,590	3,056,174	[5] 3,062,130	[5] 2,715,821
Sulphuric acid [6]........do....	(1 2)	(1 2)	(1 2)	(1 2)
Miscellaneous [7]........	....	15,367,604	....	14,872,512
Total value, eliminating duplications.....	....	346,564,746	....	290,118,914

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] From zinc smelting.
[7] Includes minerals indicated by "1" and "5" above.

Mineral production of Wisconsin in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Barite......short tons	976	$4,212	(1)	(1)
Briquets, fuel......do	729,159	[2] 5,949,852	564,621	[2] $4,640,722
Cement......barrels	(1)	(1)	(1)	(1)
Clay products		[3] 2,801,309		[3] 2,778,533
Clay, raw......short tons	500	[2] 500	140	[2] 240
Coke......do	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore:				
Sold to furnaces......long tons	1,789,721	4,848,978	1,148,277	3,179,175
Sold for paint......do	1,515	(1)	1,372	(1)
Lead......short tons	1,536	193,536	1,537	153,700
Lime......do	130,902	1,094,388	64,989	598,739
Marl, calcareous......do			(1)	(1)
Mineral paints, zinc and lead pigments......short tons	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters......gallons sold	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Lead......short tons	400	(5)		
Lead-zinc......do	404,300	(5)	457,000	(5)
Zinc......do	202,400	(5)	29,400	(5)
Pyrites......long tons	(1)	(1)	13,541	(1)
Sand and gravel......short tons	10,727,632	4,574,182	7,082,063	2,801,713
Sand and sandstone (finely ground)......do			(1)	(1)
Sand-lime brick......thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz)......short tons	(1)	(1)	(1)	(1)
Stone......do	[6] 4,004,200	[6] 6,166,708	[6] 3,370,750	[6] 5,100,266
Sulphuric acid [7]......do	(1 2)	(1 2)	(1 2)	(1 2)
Talc......do	4,350	14,238	1,078	3,499
Zinc......do	16,986	2,242,152	12,558	1,205,568
Miscellaneous [8]		8,273,837		7,024,577
Total value, eliminating duplications		24,222,229		17,711,394

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of basalt and unclassified stone in 1929 and of basalt in 1930, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Wyoming in 1929 and 1930

Product	1929		1930	
	Quantity	Value	Quantity	Value
Cement......barrels	(1)	(1)	(1)	(1)
Clay products		[2] $172,630		[2] $177,445
Clay, raw......short tons	22,055	[3] 190,171	25,010	[3] 249,797
Coal......do	6,704,790	17,052,000	6,088,133	15,133,000
Copper......pounds	4,301	757	11,600	1,508
Gold......troy ounces	48	995	443	9,158
Gypsum......short tons	(1)	(1)	(1)	(1)
Iron ore......long tons	639,477	(1)	320,023	(1)
Lime......short tons			(1)	(1)
Mineral waters......gallons sold	(4)	(4)	(4)	(4)
Natural gas......M cubic feet	44,648,000	3,850,000	43,219,000	4,277,000
Natural gasoline......gallons	44,544,000	3,241,000	51,132,000	3,338,000
Ores (crude), etc.:				
Copper......short tons	28	(5)	112	(5)
Dry and siliceous (gold and silver)......short tons	115	(5)	1,173	(5)
Petroleum......barrels	19,314,000	24,700,000	17,868,000	22,350,000
Phosphate rock......long tons	2,679	12,750	1,339	6,000
Sand and gravel......short tons	(1)	(1)	(1)	(1)
Silver......troy ounces	26	14	122	47
Sodium salts (carbonate and sulphate) from natural sources......short tons	(1)	(1)	(1)	(1)
Stone......do	322,260	473,678	[6] 207,380	[6] 343,637
Miscellaneous [7]		1,733,583		1,099,389
Total value, eliminating duplications		51,237,407		46,735,184

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

PREFATORY NOTE TO THE REPORTS ON GOLD, SILVER, COPPER, LEAD, AND ZINC

By O. E. Kiessling

Chief Economist, Division of Mineral Statistics

In the mining industry, gold, silver, copper, lead, and zinc are closely related in both the genesis and the geologic occurrence of their ores, as well as in mining and in metallurgical treatment. Of their ores some contain all five metals, many contain three or four, and few contain only one. Gold and silver, for instance, almost everywhere show close genetic relations, and their ores are usually mined together. Lead and zinc constitute a similar pair. Copper ores almost invariably yield some silver and gold as well as copper, and most lead ores yield notable supplies of silver. Zinc ores in the Western States contribute also to the production of silver. All five metals may occur in commercial quantity in a single mine or, more commonly, in a single mining district. For these reasons each of these metals is treated in Mineral Resources in a general report, and all five metals are grouped together in "mine reports" descriptive of individual or geographically grouped States. These reports are printed in 15 pamphlets.

To facilitate advance publication each report is published separately at the earliest date possible. The general reports give figures of the output of the metals in the first marketable form, as obtained from the smelters, refineries, and mints, together with general reviews of the respective industries for the entire country. The figures given in the general reports represent the final official statistics of production for the country and of the States. The general report on gold and silver includes the statistics of recovered precious metals as determined by the Bureau of the Mint. The "mine reports" give figures of the production (called "mine production") as obtained from the mines, so far as possible in terms of both gross and recoverable metal in ores and other material sold or treated during the year; they also supply information in detail relative to the mining industry in the respective States, counties, and mining districts.

These reports, which appear as separate chapters in this volume, are as follows:

Gold and silver (general report).
Copper (general report).
Lead (general report).
Zinc (general report).
Silver, copper, lead, and zinc in the Central States (mine report).
Gold, silver, copper, lead, and zinc in the Eastern States (mine report).
Gold, silver, copper, lead, and zinc in Arizona (mine report).

Gold, silver, copper, lead, and zinc in California and Oregon (mine report).
Gold, silver, copper, lead, and zinc in Colorado (mine report).
Gold, silver, copper, lead, and zinc in Idaho and Washington (mine report).
Gold, silver, copper, lead, and zinc in Montana (mine report).
Gold, silver, copper, lead, and zinc in Nevada (mine report).
Gold, silver, copper, lead, and zinc in New Mexico and Texas (mine report).
Gold, silver, copper, and lead in South Dakota and Wyoming (mine report).
Gold, silver, copper, lead, and zinc in Utah (mine report).

In stating quantity of ores, concentrates, and similar material the short ton of 2,000 pounds is used throughout. The term "ore" as used here denotes any metalliferous material treated at the mine or shipped to reduction plants and paid for by those plants, whether or not it nets a profit to the miner. The ore classification is necessarily arbitrary, because of the varying factors affecting mining and treatment of ores. Dry and siliceous ores comprise gold and silver ores proper, as well as fluxing ores that carry considerable quantities of iron and manganese oxides and very small quantities of gold and silver and also gold and silver ores that carry copper, lead, or zinc in quantities too low to classify them as copper, lead, zinc, or mixed ores. The copper ores include the great disseminated copper deposits of the West, the copper ores of the Lake Superior region, and other ores in which copper is the most abundant base metal paid for. The lead and zinc ores are those in which lead or zinc is the only or chief base metal present, irrespective of their precious-metal content. The mixed ores are those whose commercial value depends on the recoverable or recovered contents of two or more base metals in addition to any precious metals they may contain. If one of the metals, though present in sufficient quantity, is not recovered, that metal is disregarded in naming the ore. An improvement in metallurgy may later serve to change the name of such ore. The classification based on methods of treatment is the only satisfactory commercial classification.

It is to be understood, of course, that market values are not received by producers for metals in ore and intermediate products nor always for metals in marketable form, that payment is made in accordance with contracts for treatment or sale, and therefore that average daily quotations do not necessarily agree with average prices received.

Prices of silver, copper, lead, and zinc, 1850–1930

Year	Silver [1]	Copper [2]	Lead [3]	Zinc [4]	Year	Silver [1]	Copper [2]	Lead [3]	Zinc [4]
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1850	$1.32	$0.22	$0.05	---------	1891	$0.99	$0.128	$0.043	$0.05
1851	1.34	.166	.05	---------	1892	.87	.116	.041	.046
1852	1.33	.22	.05	---------	1893	.78	.108	.037	.04
1853	1.35	.22	.06	$0.055	1894	.63	.095	.033	.035
1854	1.35	.22	.06	---------	1895	.65	.107	.032	.036
1855	1.34	.27	.07	---------	1896	.68	.108	.03	.039
1856	1.34	.27	.066	---------	1897	.60	.12	.036	.041
1857	1.35	.25	.06	---------	1898	.59	.124	.038	.046
1858	1.34	.23	.06	---------	1899	.60	.171	.045	.058
1859	1.36	.22	.055	---------	1900	.62	.166	.044	.044
1860	1.35	.23	.056	---------	1901	.60	.167	.043	.041
1861	1.33	.22	.05	---------	1902	.53	.122	.041	.048
1862	1.35	.22	.06	---------	1903	.54	.137	.042	.054
1863	1.345	.34	.06	---------	1904	.58	.128	.043	.051
1864	1.345	.47	.07	.139	1905	.61	.156	.047	.059
1865	1.337	.392	.066	---------	1906	.68	.193	.057	.061
1866	1.339	.342	.07	---------	1907	.66	.20	.053	.059
1867	1.33	.254	.065	---------	1908	.53	.132	.042	.047
1868	1.326	.23	.065	---------	1909	.52	.13	.043	.054
1869	1.325	.242	.06	---------	1910	.54	.127	.044	.054
1870	1.328	.212	.06	---------	1911	.53	.125	.045	.057
1871	1.325	.241	.06	---------	1912	.615	.165	.045	.069
1872	1.322	.356	.064	---------	1913	.604	.155	.044	.056
1873	1.297	.280	.06	---------	1914	.553	.133	.039	.051
1874	1.278	.220	.06	---------	1915	.507	.175	.047	.124
1875	1.24	.227	.058	.07	1916	.658	.246	.069	.134
1876	1.16	.21	.061	.072	1917	.824	.273	.086	.102
1877	1.20	.19	.055	.06	1918	1.00	.247	.071	.091
1878	1.15	.166	.036	.049	1919	1.12	.186	.053	.073
1879	1.12	.186	.041	.052	1920	1.09	.184	.08	.081
1880	1.15	.214	.05	.055	1921	1.00	.129	.045	.05
1881	1.13	.182	.048	.052	1922	1.00	.135	.055	.057
1882	1.14	.191	.049	.053	1923	.82	.147	.07	.068
1883	1.11	.165	.043	.045	1924	.67	.131	.08	.065
1884	1.11	.13	.037	.044	1925	.694	.142	.087	.076
1885	1.07	.108	.040	.043	1926	.624	.14	.08	.075
1886	.99	.111	.046	.044	1927	.567	.131	.063	.064
1887	.98	.138	.045	.046	1928	.585	.144	.058	.061
1888	.94	.168	.044	.049	1929	.533	.176	.063	.066
1889	.94	.135	.039	.05	1930	.385	.130	.050	.048
1890	1.05	.156	.045	.055					

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[1] Report of Director of the Mint, pp. 212–213, 1914. Equivalent value of fine ounce based on average price and average rate of exchange. For 1916, 1917, and 1919, dealers' buying price, New York. For 1918, early estimate furnished by the Bureau of the Mint. For 1920 to 1922, New York market price for domestic silver only. For 1923, average price under Pittman Act, from Jan. 1 to June 2, for domestic silver; average New York price for all silver after that period. For 1924 and later years, average New York price for bar silver.

[2] Weed, W. H., Copper Handbook, vol. 11, pp. 1339, 1343, for years 1850–1903. By computation from data for years 1850–1860, p. 1339. U. S. Geological Survey computations for electrolytic copper since 1904. For 1916 and later years, average price all marketable grades.

[3] New York price, Ingalls, W. R., Lead and Zinc in the United States, p. 203, 1908. U. S. Geological Survey since 1904. For 1916, outside spot quotations, New York. For 1917 and later years, average price all grades.

[4] New York price, 1875–1904, Ingalls, W. R., Lead and Zinc in the United States, p. 342, 1908. St. Louis price, U. S. Geological Survey, since 1904. For 1915 and later years, average price all grades. Oral communication from C. E. Siebenthal, of the U. S. Geological Survey, for 1853 and 1864.

ANTIMONY [1]

By Paul M. Tyler [2]

CONTENTS

	Page
Statistical summary	1
Introduction	1
Markets and prices	2
Domestic production	3
Smelter production of antimonial lead	5
Recovery of secondary antimony	5
Imports and exports	6
Metallurgy	7
Tariff	8
World production	8
Algeria	9
Bolivia	10
Canada	10
China	10
Mexico	11
Peru	12
Russia	12
South Africa	12
Yugoslavia	12
Bibliography	12

STATISTICAL SUMMARY

Summary of statistics for antimony in the United States, 1927–1930

	1927	1928	1929	1930
Average price for year of antimony at New York ..... cents per pound	12.34	10.30	8.94	7.67
Imports for consumption:				
Antimony in ore ..... short tons	2,015	2,185	1,865	863
Liquated antimony sulphide ..... do	1,077	1,208	1,803	713
Metal ..... do	9,891	9,684	11,073	7,700
Oxide ..... do	1,312	2,268	1,892	690
Exports of foreign antimony ..... do	363	599	509	493
Stocks of antimony in bonded warehouse at end of year ..... do	1,773	1,471	1,461	(1)
Production of antimony ore ..... do	--------	86	--------	--------
Antimony contained ..... do	--------	42	--------	--------
Production of antimonial lead (from domestic and foreign ores) ..... do	24,347	33,058	25,669	13,711
Antimony contained ..... do	2,736	3,432	3,052	1,685
Recovery of secondary antimony ..... do	12,400	11,900	11,131	8,082

[1] Figures not yet available.

INTRODUCTION

The domestic consumption of new antimony, as indicated by the import statistics, dropped off more than one-third in 1930. The imports of ore and liquated (crude or needle) antimony suffered more than those of the metal, and the imports of antimony oxide were cut to relatively small quantities.

As antimony is used largely in storage-battery plates, bearing and Babbitt metals, solder, rubber goods, paints, and fixtures, its market depends upon the pace of general industrial activity and especially upon automobile manufacture. As compared with the high records of 1929 the apparent consumption of Babbitt metal decreased 35 per cent,[3] the imports of antimony metal 30 per cent, and the number of finished automobiles and trucks 37 per cent.[4]

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[1] Work on manuscript completed May, 1931.

[2] Unless otherwise stated, statistics in this report were prepared by H. M. Meyer and data on imports and exports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines. E. P. Youngman, also of the Bureau of Mines, assisted in assembling data with respect to foreign countries.

[3] U. S. Department of Commerce, Survey of Current Business: No. 114, February, 1931, p. 27; No. 115, March, 1931, p. 27.

[4] Work cited, No. 114, p. 28.

MARKETS AND PRICES

Until recently the antimony market has been notoriously subject to violent price fluctuations, but during the last two or three years prices have changed slowly. The trend of prices has been steadily downward since the beginning of 1926, when the exceptionally high level of 25 cents a pound was reached. The recession has progressed in orderly fashion, however, and in 1930 the major trend in New York quotations (duty paid) was a gradual decline from a little above 8 cents at the beginning of the year to about 7⅛ cents at the end. In the early months, news of recurrent Chinese uprisings and the possibility of a higher tariff in the United States tended to advance prices, and during the summer renewed fears as to the Chinese situation induced a reaction from the low point reached in June. At times supplies of the metal seemed likely to be cut off completely by the bandit activity in and near the principal producing districts, and at other times demand dropped to the vanishing point. The extraordinary decline in the price of silver and its disturbing effect upon the rates of exchange in far eastern countries constituted another uncertain factor, of importance because of the relatively long period that must normally elapse before metal purchased in China could be delivered and sold in New York. Briefly, virtually all the elements that in the past have encouraged speculation and violent changes in price were present in the market in 1930, and in view of these circumstances the magnitude of the actual fluctuations appears astonishingly small. One reason for the stabilization of prices is the lessened tendency for speculation that has apparently resulted from the marked reduction in the number of traders and dealers in the metal. In New York in particular the import business in antimony is now conducted principally by about four firms, whereas even a few years ago there were a dozen or more active dealers.

Cookson's "C" grade, which started the year at 14 cents a pound, dropped to 12⅞ cents in May, remaining at that figure until the end of the year.

The Engineering and Mining Journal prices of Chinese needle antimony remained at 8 cents a pound for lump and 10 cents a pound for powdered (200-mesh) until July, when they ceased to be reported. The Oil, Paint, and Drug Reporter quotations for powdered antimony were lowered from 9½ to 10½ cents in January to 8½ to 9 cents in December. In London the price of crude antimony was gradually reduced from £26 to £22 a ton, or from about 5.65 to 4.78 cents a pound.

The quotations for antimony oxide, which broke badly in 1929, declined somewhat further in 1930. Quotations through much of the year remained at 8½ to 10 cents, according to quantity, as compared with 10½ to 11 cents in January. Most of the other antimony compounds held firm or declined only slightly, except white pigment, which closed the year at 13 to 13½ cents as compared with 16½ to 17 cents in January.

Bolivian ore, containing 60 per cent antimony, was quoted at the beginning of the year at $1.30 per short-ton unit in New York, but after dropping to $1.15 quotations ceased as no sales were reported. In London the price dropped gradually from 5s. 9d. or 6s. in January to 4s. per long-ton unit in July. The latter quotation, which remained unchanged throughout the second half of the year, is equivalent to 85 to 90 cents a short-ton unit. For 50 per cent ore the quotation at the end of the year was 3s. a long-ton unit.

Chinese metal, which sold in London early in the year at £32, dropped to £26 or less in December; as the year closed spot metal was available at £23 5s. a ton, or about 5½ cents a pound. New York quotations for recent years are summarized in the following table:

Prices of antimony (Chinese brands) per 100 pounds at New York City, 1913 and 1920–1930 [1]

Year	High	Low	Average	Year	High	Low	Average
1913	$9.250	$6.250	$7.520	1925	$20.250	$11.250	$17.494
1920	11.375	5.750	8.485	1926	23.750	9.500	15.988
1921	5.500	4.500	4.957	1927	15.000	10.750	12.393
1922	7.000	4.250	5.471	1928	11.375	9.500	10.305
1923	9.250	6.350	7.897	1929	9.750	8.250	8.956
1924	14.125	8.375	10.836	1930	8.875	6.750	7.667

[1] Compiled from Engineering and Mining Journal.

DOMESTIC PRODUCTION

In the United States the outstanding event of the year was the construction of a new antimony smelter, which started production on December 31, 1930. Except for the ever-growing output of secondary antimony, largely from storage-battery plates, and the antimonial lead produced at lead smelters little antimony metal has been made in this country since the World War. The new plant is at Laredo, Tex., and it is operated by the Texas Mining & Smelting Co., H. P. Henderson, president. The Republican Mining & Metal Co., the Mexican subsidiary of the Cookson interests, is said to have a minority interest in the new concern, which has the right to sell in the United States the R. M. M. brand of regulus containing 99.3 per cent antimony and under 0.1 per cent arsenic. The new brand is called "Lone Star." and the range of analysis for the first 140 tons is reported by Henderson as follows:

	Per cent		Per cent
Sb	99.820–99.880	Bi	None.
S	.022– .050	Pb	0.020–0.020
Fe	.012– .035	Cu	None.
As	Trace.	Zn	None.

As in 1929, no production of antimony ore in the United States was reported for 1930. The production of antimonial lead from domestic ores containing antimony was 8,918 short tons, with an antimony content of 1,302 tons, and that from foreign ores was 4,793 tons, with an antimony content of 383 tons; the output from foreign ores represents a decrease in gross weight and antimony content of about 45 per cent as compared with 1929 and of about 70 per cent as compared with 1928. Much of the lead base bullion containing antimony that was formerly shipped from Mexico to the United States is now refined in Mexico. The recovery of antimony from old alloys, scrap, and dross in 1930 was 8,082 short tons; in 1929 the recovery was 11,131 tons.

According to the Federal census the domestic production of antimony chloride was 261,959 pounds, valued at $42,565, in 1929, as compared with 165,890 pounds, valued at $27,437, in 1927. The value of other antimony salts produced in the United States rose from $349,172 in 1927 to $508,617 in 1929; no figures for 1930 are available, but production probably was less than in 1929.

Mine production of antimony ores in the United States, 1921–1930, in short tons [1]

Year	Ore	Antimony content	Year	Ore	Antimony content
1922	20	4	1925	125	52
1923	40	10	1926	100	45
1924	113	33	1928	[illegible]	42

[1] No production reported for 1921, 1927, 1929, and 1930.

In the Yellow Pine district of Idaho development was continued, but the present program probably will not result in reaching production for another two years. The ores are gold ores that contain about 1 per cent of stibnite, which may be recovered by selective flotation.

Work during 1927 and 1928 resulted in the production of a little 40 per cent ore by the Triangle Mining Co., lessee, from the Desert antimony mine situated in the Clark Mountain district, California, about 12 miles southwest of Roach, Nev. The property, which was idle in 1930, has been described as follows:[5]

> The country rock is granite. Three parallel veins occur in the granite, their strike being N. 20° E.; dips vary from 75° west to vertical. Width of veins vary from 2 to 4 feet. These veins are about 50 feet apart and most of the development work has been confined to the west vein. The ore so far developed occurs on the footwall, and the high-grade ore has a width of 12 inches to 2 feet. It is reported that ore mined carried from 15 to 20 per cent antimony and was sorted to carry from 40 to 60 per cent antimony. The ore is in the form of stibnite (Sb_2S_3).
>
> *Development.*—On the east vein, a tunnel has been driven west 30 feet to the vein, at which point a winze has been sunk to a depth of 30 feet. From the bottom of the winze a drift has been run 40 feet on the vein. This work has exposed a vein 4 feet in width with 2 feet of ore on footwall. West vein: On this vein a shaft has been sunk to a depth of 100 feet. At a depth of 50 feet there is a drift north 100 feet and south 40 feet. The vein material exposed in these workings consists of quartz, calcite, and barite, mineralized with stibnite. In the north drift the vein has been stoped for a length of 80 feet to the surface. The ore extracted from this stope is reported to have carried from 30 per cent to 50 per cent antimony. In the bottom of the shaft there is 6 inches of high-grade ore. About 300 feet south of the shaft and 100 feet vertically below the collar of the shaft, a tunnel has been driven south 150 feet on the west vein. The middle vein has been developed by a number of open cuts for a distance of 1,000 feet along its outcrop.
>
> Mine equipment consists of a 12-horsepower Western gas-engine hoist. Reduction equipment consists of one 10-ton furnace. Idle.

The following notes on antimony in Alaska are taken from the annual review by Philip S. Smith:[6]

> Late in the fall of 1928 it was reported that arrangements were in progress for an English company to take over the development of a group of claims on Stampede Creek, in the Kantishna district, that were known to contain numerous showings of antimony ore. The promotion of the project was handled principally by George F. Lemon. Before development is undertaken here, however, very complete examinations will be required to determine the extent of the mineralization and the tenor of the ore. This is especially essential because there is small likelihood that the project will be undertaken unless it is worth carrying through on a large scale, as the company was not interested in taking hold of a small or moderate-sized venture in that rather remote region, realizing that economical development would call for considerable outlays for transportation and other facilities.
>
> Antimony minerals are widely distributed through Alaska, and the common antimony mineral, stibnite, is recognized in most of the mineralized areas in the

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[5] Tucker, W. B., and Sampson, R. J., Report XXVI of the State Mineralogist—Los Angeles Field Division: Mining in California, vol. 26, No. 3, July, 1930, pp. 204–205.

[6] Smith, P. S., Mineral Industry of Alaska in 1929: U. S. Geol. Survey Bull. 824–A, 1930, p. 79.

interior. In the past, antimony ore valued at more than a quarter of a million dollars has been mined in the Territory and sold. There has been little demand for this metal lately, and the market for it is said to be fairly closely controlled. As a consequence there has been little interest in the search for deposits of this metal or development of those properties already known which might prove profitable if the ore were readily marketable.

SMELTER PRODUCTION OF ANTIMONIAL LEAD

By-product antimonial lead produced in the United States from both foreign and domestic ores, 1921–1930

Year	Short tons	Antimony content		Year	Short tons	Antimony content	
		Short tons	Value[1]			Short tons	Value[1]
1921	10,064	1,589	$158,000	1926	22,524	2,693	$856,400
1922	8,075	1,441	156,000	1927	24,347	2,736	675,800
1923	14,190	2,170	338,500	1928	33,058	3,432	707,000
1924	20,787	2,763	596,800	1929	25,669	3,052	545,700
1925	19,667	2,624	918,400	1930	13,711	1,685	258,500

[1] Calculated at average yearly price for ordinary brands of antimony as given by American Metal Market.

RECOVERY OF SECONDARY ANTIMONY

During 1930, according to J. P. Dunlop, of the Bureau of Mines, the recovery of antimony from old alloys, scrap, and dross was 8,082 short tons, as compared with 11,131 tons in 1929. Of the 1930 total 1,282 tons was recovered from antimonial-lead scrap treated at regular smelters, and 6,800 tons was recovered as metal and in alloys at secondary smelters. In addition to the antimony recovered in metallic condition a considerable quantity of sodium antimonate was accumulated at plants using the Harris process.

Secondary antimony and antimony content of secondary alloys recovered from old alloys, scrap, and dross in the United States, 1921–1930

Year	Short tons	Value[1]	Year	Short tons	Value[1]
1921	4,720	$464,400	1926	16,230	$5,164,400
1922	7,090	765,700	1927	12,400	3,060,300
1923	8,021	1,252,800	1928	11,900	2,451,400
1924	9,404	2,025,600	1929	11,131	1,990,200
1925	10,840	3,794,000	1930	8,082	1,239,800

[1] Values calculated at average yearly price for ordinary brands of antimony as published by the American Metal Market.

The antimony in battery plates is used over and over again. New battery plates contain as much as 6 or 7 per cent of antimony, but (because of admixture of lead oxide and various impurities) old plates when smelted directly yield an alloy containing only about 4 per cent antimony and 96 per cent lead. This alloy is not disposed of readily and even when sufficient antimony ore is added in smelting to bring the alloy up to the analysis of new plate material the product can not ordinarily find a market outside the rather narrow limits of the battery trade. C. R. Hayward's process for treating storage-battery plates, which yielded successfully soft lead and alloys containing up to 80 per cent antimony, has been perfected further so that even higher antimony alloys can now be made. From a practical point of view this is important, as it permits marketing the reclaimed metals for other uses when the demand for battery lead is slack.

IMPORTS AND EXPORTS

Antimony imported for consumption in the United States, 1921–1930

Year	Antimony ore			Liquated antimony sulphide		Metallic antimony		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1921	213	98	$11,682	353	$17,577	10,130	$784,146	154	$15,558
1922				689	40,108	9,344	659,242	379	65,538
1923	(1)	1,047	44,721	835	64,493	6,763	641,804	2,277	288,206
1924	(1)	899	62,999	558	52,393	6,778	840,434	1,207	190,252
1925	1,359	773	47,084	760	115,990	9,857	2,362,915	1,792	349,990
1926	2,497	1,559	287,258	2,040	343,705	11,506	3,144,330	2,259	517,584
1927	3,566	2,015	282,098	1,077	134,949	9,891	2,111,411	1,803	484,873
1928	3,912	2,185	313,127	1,208	158,231	9,684	1,641,265	2,643	448,156
1929	3,161	1,865	231,086	1,803	174,104	11,073	1,622,182	2,222	359,247
1930	1,461	863	91,499	713	45,806	7,700	883,448	783	119,314

[1] Figures not available.

Antimony imported into the United States, 1929 and 1930 [1]

[General imports]

Country	Antimony ore			Antimony metal [2]	
	Gross weight (short tons)	Antimony content		Short tons	Value
		Short tons	Value		
1929					
Argentina	1,060	697	$70,291		
Belgium	(3)	(3)	30	1,112	$185,070
Bolivia [4]	166	101	10,716		
Canada	(3)	(3)	9		
Chile [4]	940	587	68,844	17	2,018
China [5]				10,524	1,360,401
France				28	3,565
Germany				76	12,073
Hong Kong [5]	1	1	27	204	18,116
Mexico	946	448	79,417	1,180	181,708
Peru	48	31	1,752		
United Kingdom				289	68,379
	3,161	1,865	231,086	13,430	1,831,330
1930					
Argentina	731	489	43,962		
Belgium				273	38,227
Chile [4]	81	43	5,921		
China [5]	308	194	16,992	6,628	654,828
Germany				28	3,213
Hong Kong [5]				34	3,764
Mexico	341	137	24,624	1,402	175,157
United Kingdom				141	27,797
	1,461	863	91,499	8,506	902,986

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[1] Includes large quantities of antimony metal that went into bonded warehouse and that are not included in the table of imports for consumption.

[2] Includes small quantities of liquated antimony sulphide, known in the trade as "crude antimony," "antimony matte," or "needle antimony."

[3] Less than 1 ton.

[4] Imports credited to Chile originated mainly in Bolivia.

[5] Nearly all the imports of antimony ore and metal from Hong Kong are of Chinese origin. Some of the material credited to other countries is possibly also of Chinese origin, having been transshipped in a foreign port.

Type metal[1] *imported for consumption in the United States, 1921–1930*

Year	Type metal		Assumed antimony content		Year	Type metal		Assumed antimony content	
	Short tons	Value	Short tons	Percentage		Short tons	Value	Short tons	Percentage
1921	19,485	$1,191,553	4,132	21.2	1926 [1]	4,311	$912,331	784	18.2
1922	22,448	1,120,814	5,476	24.4	1927 [1]	439	65,049	106	24.1
1923	[2] 3,677	431,610	(3)	(3)	1928 [1]	1,995	193,177	452	22.6
1924	[2] 644	100,367	(3)	(3)	1929 [1]	2,720	180,679	295	10.8
1925 [1]	3,005	463,134	850	28.3	1930 [1]	328	32,934	53	16.2

[1] Classification for 1925 to 1930 is "Type metal and antimonial lead"; separate figures not recorded.
[2] Lead content only. Figures for gross weight for 1923 and 1924 not available.
[3] Data not available.

Foreign antimony (matte, regulus, or metal) exported from the United States, 1921–1930[1]

Year	Short tons	Value	Year	Short tons	Value
1921	150	$15,741	1926	184	$41,554
1922	19	1,548	1927	363	72,280
1923	8	1,047	1928	599	90,975
1924	140	14,441	1929	509	71,415
1925	94	17,376	1930	493	54,634

[1] During 1922 there was also exported, mainly to Canada, 112 tons of regulus or metal of domestic manufacture, valued at $13,961. This is the first export of domestic antimony of which there is any record. However, antimony manufactured in the United States from foreign ores and exported would also be classed as domestic exports. Similar exports for 1923–1930 are not shown.

METALLURGY

In a paper presented at the World Engineering Congress in Tokyo, Japan, in 1929 Wang[7] reviewed the present practice in antimony recovery. The old processes of liquation and precipitation are still the usual means of recovering the metal from its ores in England, whereas on the Continent roast-reduction processes are more in favor. In China, where most of the world's antimony is produced, the modern smelting works have been closed as they can not compete under postwar conditions with smaller plants employing more primitive methods but carrying smaller overhead and amortization expenses. Selective flotation of antimony ores having previously proved feasible with Canadian ores, an investigation of the flotation of Australian ore was undertaken and successfully completed.[8] A German magazine[9] includes notes on progress in the treatment of ores of antimony, as well as those of other metals.

The Pacific Experiment Station of the Bureau of Mines, in cooperation with the University of California, has continued to study the removal of antimony in the processes of smelting and refining lead. Several papers covering the physical constants of antimony oxides have been published. The direct oxidation of antimony in lead bullion by the tetravalent or pentavalent antimony oxide in the semiliquid oxide skin is also being investigated. It appears that the trivalent oxide in the slag is oxidized by the atmosphere of the softening furnace to a higher valent form, which in turn migrates to the bullion surface where it oxidizes the antimony dissolved in the molten bullion. Due to valence changes the antimony in the oxide skin, therefore, may act as an oxygen carrier from the atmosphere above to the metal below.

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[7] Wang, C. Y., Present Status of the Metallurgy of Antimony (Abstract): Eng. and Min. World, vol. 1, August, 1930, pp. 423–425.
[8] Clarke, W. G., and Moore, B. H., Flotation of Antimonial Ore from Wiluna: Chem. Eng. and Min. Rev., vol. 22, No. 260, May 5, 1930, pp. 294–5.
[9] Tafel, V., Ore Treatment; Metallurgy in 1929: Metall u. Erz, vol. 27, No. 12, 2d June issue, 1930; Eng. and Min. Jour., vol. 130, No. 6, Sept. 25, 1930, p. 295.

Research at the Bureau of Standards [10] indicates that the addition of 1 per cent of antimony to copper-tin-lead bearing bronzes did not give quite as good results as the addition of zinc or phosphorus.

TARIFF

The customs duties on antimony imported into the United States under the tariff act of 1930 follow:

Designation	Paragraph	Rate
Antimony ore	1608	Free.
Needle or liquated (crude)	376	¼ cent per pound.
Regulus or metal	376	2 cents per pound.
Antimony oxide	8	Do.
Tartar emetic or potassium antimony tartrate	8	6 cents per pound.
All other antimony salts	8	1 cent per pound and 25 per cent.[1]

[1] On foreign market value.

The antimony contents of antimonial lead, antimonial scrap lead, reclaimed lead, scrap lead, babbitt, and "all compounds and combinations of lead not specially provided for" are exempt from duty; on such materials a duty of 2⅛ cents per pound on the lead contents only is provided in paragraph 392 of the Hawley-Smoot Tariff Act.

WORLD PRODUCTION

The low prices that prevailed in 1930 did not encourage production in the higher-cost countries. In China, always the leading source of supply, local difficulties interrupted production and shipments. Despite the world-wide curtailment of demand, therefore, there was no indication of any abnormal accumulation of stocks in the producing countries at the close of the year.

The world production of metallic antimony is about 30,000 short tons a year, of which the United States consumes more than one-third. World consumption reached 50,000 tons a year during the war, but it dropped to about 20,000 tons annually for a period of years after the war.

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[10] Staples, E. M., Dowdell, R. L., and Eggenschwiler, C. E., Bearing Bronzes with Addition of Zinc, Phosphorus, Nickel, and Antimony: U. S. Bureau of Standards Jour. of Research, Research Paper 205, vol. 5, No. 2, August, 1930, pp. 349–364.

World production of antimony, 1922–1930, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [2]	1922	1923	1924	1925	1926	1927	1928	1929	1930
North America:									
Mexico	[3] 464	[3] 490	[3] 775	935	1,783	2,098	2,297	[3] 2,709	[3] 3,032
United States	4	8	24	24	31	-------	30	-------	-------
South America:									
Argentina	[3] 1	[3] 5	[4] 120	[3] 10	(5)	-------	-------	-------	(6)
Bolivia [3]	185	312	621	1,384	3,503	3,214	2,834	3,023	927
Peru	-------	-------	-------	14	79	89	112	[3] 86	[3] 47
Europe:									
Austria	139	62	1	-------	87	857	914	560	(6)
Czechoslovakia	100	453	1,066	535	938	1,586	967	556	(6)
France	834	691	1,027	964	586	714	925	1,025	1,106
Germany (Bavaria)	4	(6)	(6)	(6)	-------	-------	-------	-------	(6)
Italy	146	271	372	312	360	285	230	306	330
Portugal	-------	8	14	15	-------	-------	-------	(6)	(6)
Spain	-------	25	-------	-------	14	10	6	-------	(6)
Yugoslavia	(6)	131	414	139	182	279	258	313	(6)
Asia:									
China [3]	13,858	14,256	12,059	19,496	20,926	17,986	19,324	22,401	(6)
India, British	-------	-------	-------	5	53	244	181	38	(6)
Japan	-------	-------	10	-------	-------	-------	21	22	(6)
Turkey (Asia Minor) [7]	400	400	400	400	400	400	400	400	400
Africa:									
Algeria [3]	579	500	905	1,461	334	442	21	114	-------
Morocco, Spanish [3]	-------	-------	-------	-------	70	94	225	180	(6)
Nigeria [3]	(8)	(8)	-------	-------	-------	-------	-------	-------	(6)
Southern Rhodesia	-------	-------	-------	15	24	-------	40	-------	27
Oceania:									
Australia—									
New South Wales	-------	-------	-------	12	34	51	48	25	42
Queensland	-------	-------	-------	-------	3	2	1	-------	(6)
Victoria	605	421	130	54	-------	-------	1	1	(6)
Western Australia [3]	-------	-------	-------	-------	(9)	-------	-------	-------	-------

[1] Approximate recoverable metal content of ore produced, exclusive of antimonial lead ores.

[2] In addition to the countries listed antimony ore is reported produced in Siam, Chosen, and French Morocco, as follows: Siam, 9 tons of ore in 1924; Chosen, 21 tons of ore in 1926 and 15 tons in 1927; and French Morocco, 120 tons in 1928. As no information is available on the antimony content of these ores, the figures have not been included in the table.

[3] Exports.

[4] Shipments. A large part of the shipments reported is probably of Bolivian origin and therefore may duplicate in part the quantities shown for Bolivia.

[5] Less than 1 ton. Estimated recoverable content of shipments in 1926 was 55 kilograms.

[6] Data not available.

[7] Approximate annual output. (Imp. Inst., London.)

[8] Less than 1 ton. Estimated recoverable metal content of ores exported was as follows: 1922, 190 kilograms; 1923, figures not given.

[9] Less than 1 ton. Estimated recoverable metal content of ores exported in 1926 was 464 kilograms.

ALGERIA [11]

Antimony minerals are moderately abundant along a wide mineral belt which extends across northern Algeria. Narrow veins of senarmontite (Sb_2O_3, isometric) occur at Hammimate, and valentinite (Sb_2O_3, orthorhombic) is found at Sanza (70 km. southeast of Constantine); these deposits, contained in compact clay (gault), yielded about 3,500 metric tons of 45 per cent ore between 1878 and 1883. Next in order of exploitation were the deposits at Djebel-Taya (5 km. from the station of the same name, on the railway between Khroubs and Duvivier), where stibnite forms incrustations and follows the bedding planes of Cretaceous limestones. The Taya mines were worked intermittently from 1891 to 1895 and from 1906 to 1911, producing about 2,000 tons of 45 to 55 per cent ore. At Aïn-Kerma (17 km. northwest of Constantine) stibnite, altered near the surface to the yellow oxide, cervantite (SbO_2),occurs along the contact between Triassic marl and Cretaceous (aptien) limestone and as a fracture filling. A concession was granted for this deposit to a private company in 1923; but previously it was actively worked during the World War in the interest of the French Government, producing in all 17,000 tons of ore, chiefly cervantite, to the end of 1928. During the war antimony minerals, including "flajolotite" (antimonate of iron) and "nadorite" (an oxidized antimony mineral containing lead chloride) associated with zinc, were also mined at Hammam N'Bails.

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[11] Bétier, M. G., Aperçu de l'état actuel de mise en valeur des richesses minérales de l'Algérie: Revue ind. min. No. 231, Aug. 1, 1930, Mém., pp. 324, 348.

BOLIVIA

After the World War it was generally conceded that Bolivia was not in a position to produce antimony on an extensive scale, except when prices remain above about 10 cents delivered in New York, without duty (about 12 cents, duty paid). That this figure is rather high with respect to a moderately substantial portion of the output is indicated by the record of production. The level of 7,409 tons of ore was reached in 1926 and was maintained fairly well throughout 1929, when 6,093 metric tons was produced and exported despite the fact that the average price for regulus was under 7 cents (8.96 cents in New York, duty paid). Export taxes have been remitted, but in 1930, when world prices averaged about 5 cents, the rate of production was greatly reduced. Only 1,852 metric tons of ore, valued at $138,062, was produced and exported during 1930, as compared with more than three times that amount (6,093 tons, valued at $524,293) during the preceding year.

According to official statistics the average antimony content of exports from Bolivia exceeds 60 per cent. The ore is shipped principally to Europe, chiefly to Belgium and England. Exports to the United States were 967 tons in 1928 and 786 tons in 1929 and apparently consisted of lower-grade ore than that shipped to other countries.

CANADA

Antimony ore is found in many Canadian provinces, and several deposits have been operated more or less intermittently for antimony (chiefly as a by-product of gold). A little antimony is sometimes recovered from the silver-lead-bismuth bullion produced by smelters treating cobalt ores. Imports of antimony into Canada in 1930 amounted to 1,303,560 pounds, valued at $87,027, as compared with 1,746,525 pounds, valued at $147,643, in 1929. The imports of antimony salts in 1930 amounted to 21,146 pounds, valued at $3,691, as compared with 59,049 pounds, valued at $8,822, during 1929.

In the Taku district of northern British Columbia, east of Skagway, Alaska, a new find was reported in 1930. On the Whitewater group, some 2 miles or more southeast of the Talsequah River, a 6-foot vein of stibnite has been uncovered alongside a vein of solid quartz 22 feet wide and carrying $16.50 in gold. The vein has been traced for 5,000 feet.[12]

CHINA

In 1930 China supplied the United States with 6,382 short tons of regulus, 348 tons of oxide, and 801 tons of crude antimony, as compared with 8,500, 1,611, and 1,814 tons, respectively, in 1929.

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[12] Lee, C. M., Stibnite Find in Taku: Canadian Min. Jour., vol. 51, No. 31, Aug. 1, 1930, p. 751.

The city of Changsha and in fact the whole Province of Hunan, the principal source of world supply, was overrun by bandits early in the year, and river transport was delayed several times. The actual mining areas, however, were comparatively quiet, and despite local difficulties production continued and probably would have been much greater had it not been for the lack of foreign buying. In south China [13] primitive furnaces were at one time located near the mines at Fengyi and Penchow, and the Fengyi mine was recently surveyed by foreign engineers with a view to introducing modern machinery; however, the matter either was dropped or was suspended until market conditions improve. In 1908 the Kwangsi provincial authorities built a smelter at Wuchow, but this proved a failure. Subsequently it was farmed out to private interests but has long been closed. The ore was assembled from mines in the vicinity of Tai Ping, Nanning, Poseh, and Liuchow. Another smaller smelter at Samshui discontinued operations in 1919 or earlier. During the World War several thousand tons of antimony in various forms, including nearly 1,000 tons of regulus alone in 1917, was shipped from south China. In recent years, however, the industry has been reduced to the production of a few hundred tons of ore annually, which is exported chiefly from Nanning.

According to Wang the natural sulphide of antimony was used by the ancient Chinese in paint, and diggings in Tibet indicate that it was used as a cosmetic. The history of the antimony industry in China, however, dates back only to 1897 when, under the supervision of Japanese metallurgists, the first smelter for smelting the ore to crude antimony was built. It was not until 1908 that construction of a regulus plant was undertaken. The collapse of the market after the World War closed most of the big modern smelters, and in their place small native smelters which could be built with little capital investment have sprung up. The tendency of local bandit disturbances to interrupt operations has also contributed to this condition. At present, in Hunan, about 33 works use small native furnaces, blast being furnished by hand-operated paddle arrangements.

MEXICO

The production of antimony (including the metal content of ore exported) in Mexico in 1930 compares favorably with that in any year since 1918. The marketed production, or exports, amounted to 3,032 metric tons as compared with 2,709 tons in 1929. The bulk of the output was produced in the form of metal at the smelter of the Republican Mining & Metal Co. near Wadley in San Luis Potosi. This smelter was dismantled in December, however, and ore from the near-by Catorce district will henceforth be treated at the new smelter at Laredo, Tex. The first shipments under this new arrangement were made in September, 1930. Antimony ore is also produced in Sonora in the Altar district, largely for export to the United States. Ore from the State of Oaxaca is sent to a smelter at Yucanini and made into crude antimony, and antimonial lead is recovered at Monterey.

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[13] Wang, C. Y., work cited, p. 425.

PERU

Despite the low world prices for antimony some of the Peruvian mines probably will be reopened. There are large deposits near Cuzco. Most of the stibnite produced recently in Peru has been shipped to Japan; in 1929 the output amounted to 108 tons of ore.[14]

RUSSIA[15]

Various deposits of antimony have been discovered in Russia, according to a brief news note. The deposit of gold-bearing antimony ore at Aramashevsk in the Urals has been most exploited, and it is credited with 140,000 tons of reserves. Stibnite also occurs at Suo Sioni near Kasbek, and veins have been found in the Kurtatinsh defile leading to the valley of Fiag-Dou, some 60 kilometers or more from Vladikavka. The tin deposits at Nikitovka in the Ukraine also contain antimony. A deposit of antimony in Akwolinsk in the Urals is believed to be 3 meters thick.

SOUTH AFRICA

The possibility of exploiting ores of the Antimony Reef in the Murchison Range for antimony and gold was under consideration in 1930.

YUGOSLAVIA

Serbia at one time was an important source of regulus and oxide, much of which was shipped to the United States, but production subsequently declined. Occurrences, some of them apparently of considerable commercial significance, have been reported in Slovenia, Croatia, Bosnia, and Dalmatia. According to a recent report,[16] stibnite mining has proved highly successful at Media-Izlake in the mining district of Trojana, Slovenia; the ore is made into "antoxyde," a pigment, at Semnik.

BIBLIOGRAPHY

In addition to the references noted in the foregoing pages, the following articles on antimony have appeared or become available during 1930:

ANDERSON, C. TRAVIS. The heat capacities of low temperatures of antimony, antimony trioxide, antimony tetroxide, and antimony pentoxide. Jour. Am. Chem. Soc., vol. 52, No. 7, July, 1930, pp. 2712–2720.

The heat capacities of antimony, antimony trioxide, antimony tetroxide, and antimony pentoxide, from about 60° to 300° K., have been determined and their corresponding entropies calculated. The heat of formation of antimony trioxide has been calculated.

ANDREWS, ——. Titanium, zirconium, and antimony in enamels. Ceram. Ind., vol. 14, p. 295. Foote-Prints, vol. 3, No. 1, 1930, p. 52.

Titanium oxide improves the acid resistance and does not increase the refractoriness as much as silica. Zirconium oxide is satisfactory as a mill addition. Antimony oxide, substituted for silica, improves the opacity, etc.

BLITZ, H. Notes on the separation of lead and antimony. Ztschr. analyt. Chem., 1930, T. 81, Nos. 3-4, p. 81. Chim. et ind., vol. 24, No. 5, November, 1930, p. 1074.

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[14] Burdett, William C. (U. S. consul general), The Position of the Mining Industry in Peru: Commerce Repts., Jan. 12, 1931, p. 91.

[15] Industrial and Engineering Chemistry, news ed., Antimony Minerals in Russia: Vol. 9, No. 7, Apr. 10, 1931, p. 112.

[16] Maric, L., Antimonite of Media-Izlake in Slovenia: Arhiv. Hem. Farm., vol. 4, No. 3, 1930, pp. 142-146; Jour. Am. Ceram. Soc. Abs. Bull., vol. 9, No. 12, December, 1930, p. 1095.

When an alloy containing lead and antimony is treated with nitrate and tartaric acids, the solution neutralized, and the lead precipitated by ammonium sulphide, a little antimony is carried down with the lead. This inconvenience is avoided by employing, instead of ammonium sulphide, sodium polysulphide. The antimony then remains wholly in solution as thioantimoniate.

Dean, R. S., and Ryjord, J. E. Alloys for cable sheathing. The lead-antimony alloys as cable sheathing. Metals and Alloys, vol. 1, No. 9, March, 1930, p. 410.

The 1 per cent antimony alloy in use by the Bell system has been shown by investigations in this laboratory to be a solid solution at the temperature of extrusion, about 250° C.

Dhavale, D. G. The first spark of antimony. Nature, vol. 126, No. 3168, July 19, 1930, p. 97.

While investigating the relationship of the (sp) transition of the successive elements from indium to cesium in their normal as well as ionized states, it was found that the data were insufficient. It was therefore proposed to investigate the necessary arc and spark spectra of the elements. The first uninvestigated element is antimony in the first state of ionization. With the help of a 1-meter concave grating set according to the Paschen-Runge mounting, I have photographed the entire spectrum from λ 8,500 to λ 3,000. The spectrum is analyzed and identified as arising from the transitions $(P_1 \leftarrow P_2)$, $(P_2 \leftarrow P_3)$, and $(P_2 \leftarrow Q_1)$. The lines $^3(P_2D_3)$, $^3(P_2P_2)$, $^3(P_2S_1)$ of the $(P_1 \leftarrow P_2)$ transition are 12,863, 16,714, and 19,310, respectively. The difference $^3P_1 - {}^3P_2$ is 0.4814.

Dix, E. H., Jr., Keller, F., and Willey, L. A. Equilibrium relations in aluminum-antimony alloys of high purity. Am. Inst. Min. and Met. Eng., Tech. Pub. 356, 1930, 9 pp. Chem. Abs., vol. 24, No. 21, Nov. 10, 1930, p. 5268.

From the study of a series of alloys of an extremely high purity Al (99.96) containing 0.10 to 1.14 per cent Sb, the solid solubility relations of Sb in Al were determined as well as the eutectic concentration and eutectic temperature. The alloys were heated over long periods to obtain equilibrium conditions; then chill-cast samples were microscopically examined to obtain solubility relations. The results indicate a solid solubility of less than 0.10 per cent Sb at temperatures as high as 645°. The eutectic concentration lies at about 1.1 per cent Sb, and the eutectic temperature is 657°.

Grigor'ev, A. T. Palladium-antimony alloys. Ann. Inst. Platine, 1929, No. 7, pp. 32–44. Chem. Abs., vol. 24, No. 18, Sept. 20, 1930, p. 4495.

Hincke, W. B. The vapor pressure of antimony trioxide. Jour. Am. Chem. Soc., vol. 52, No. 10, October, 1930, pp. 3869–3877.

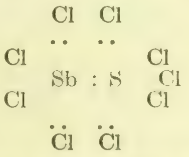
The vapor pressures of cubic and orthorhombic solid antimony trioxide have been measured between the temperatures 470° and 650° by the gas saturation method.

The vapor pressure of liquid antimony trioxide has been determined over the temperature range from 656° to 800°, using a new type of static balanced tensimeter. These values were checked by direct tensimeter measurement.

Heats of vaporization and transformation have been calculated from the vapor pressure data.

Partington, J. R. A compound of antimony chloride and sulphur chloride. Chem. and Ind. (London), vol. 49, No. 6, Feb. 7, 1930, p. 123.

In a recent number of the Journal of the Chemical Society (1929, p. 2573) P. described the formation and properties of a compound $SbCl_5$, SCl_4, but did not give a satisfactory electronic formula to the substance. The electronic formula is given herewith:



$$\begin{array}{ccccc} & \mathrm{Cl} & & \mathrm{Cl} & \\ & \cdot\cdot & & \cdot\cdot & \\ \mathrm{Cl} & & & & \mathrm{Cl} \\ & \mathrm{Sb} & : & \mathrm{S} & \mathrm{Cl} \\ \mathrm{Cl} & & & & \mathrm{Cl} \\ & \cdot\cdot & & \cdot\cdot & \\ & \mathrm{Cl} & & \mathrm{Cl} & \end{array}$$

It would seem that the compound is not formed by coordinate links at all, but has the simple formula $Cl_4Sb.SCl_5$. In such a compound all the valences are formed by normal pairs of shared electrons. The sulphur is surrounded by a normal shell of 12 electrons and the antimony by one of 10 as in $SbCl_5$. This structure would also seem to be in agreement with the chemical and physical properties of the substances.

Science Supplement. Antimony in refrigerating gas. Apr. 11, 1930, p. 12. Foote-Prints, vol. 3, No. 1, 1930, p. 36.

The new gas is composed of two ingredients carbon tetrachloride and antimony fluoride. This gas is the invention of Thomas Midgley, jr., the developer of ethyl gasoline, and of a Belgian chemist, Dr. A. L. Henne. This gas is as nontoxic as carbon dioxide and is also noninflammable. A considerable percentage of this gas in the atmosphere has no unfavorable effect upon animals.

Thews, Richard. Removal of antimony from white metals. Metallbörse, vol. 20, 1930, pp. 1545–1546, 1603. Chem. Abs., vol. 24, No. 19, Oct. 10, 1930, pp. 4740–4741.

Theoretically, the following metals are capable of forming compounds with Sb, which are of such nature that they can be removed as dross from the liquid white metal: Fe, Al, Zn, Mg, Na. Fe and Mg are practically unsuitable for this purpose. Experiments were made in utilizing Na, but the main difficulty with this metal is its low specific gravity, which renders mixing with the heavier metals extremely difficult. The combustibility of Na marks its application very wasteful. A practical ratio of Na:Sb in the melt is 1:1, but the Na content should not exceed 2 per cent to prevent the formation of great quantities of foam. In one laboratory experiment an alloy of 4 per cent Sb was reduced to 1.5 to 2 per cent Sb by this method. Plant experiments were not successful. The removal of Sb from white metals by means of S has not yet developed to commercial practice. Al is an efficient remover of Sb. One part Al is used to 2 parts Sb, and it is possible to reduce the Sb content of white metals to 0.1 per cent. Experiments were made in regard to the use of Zn for the removal of Sb. While Zn will remove a certain part of it, a large quantity and also a considerable amount of Zn remains in the white metals. The removal, or concentration of Sb, respectively, from lead slags is briefly mentioned and a method is outlined.

PATENTS

Ackerman, C. L. Lead-bearing metal alloys, based on relations of Pb-Sb-Sn. British Patent 665188, May 6, 1929. Chim. et ind., vol. 23, No. 4, April, 1930, p. 882.

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Separation of gold, silver, and lead from crude antimony by fractional crystallization.

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——— Manufacture of derivatives of organic arsenic antimony compounds. Complete specifications. British Patent 36872, 1928. (326537) Chem. and Ind. (London), vol. 49, No. 14, Apr. 4, 1930, p. 295.

——— Manufacture of soluble organic antimony compounds. Complete specifications. British Patent 36731, 1928. (326533) Chem. and Ind. (London), vol. 49, No. 14, Apr. 4, 1930, p. 295.

——— Manufacture of complex antimony salts. British Patent 326176 and 326231: (*a*) 5.12.28, (*b*) 6.12.28. Chem. and Ind. (London), vol. 49, No. 23, June 6, 1930, p. 509.

a, Antimonic acid, freshly precipitated from the pentachloride, reacts with aliphatic hydroxyacids (tartaric, gluconic, mucic, lactic, citric, etc.) to give relatively nontoxic complex salts of quinquevalent antimony—an organic base (hydroxytriethylamine) may be present; *b*, complex metal salts of aliphatic hydroxyacids are treated with oxidants, that is, hydrogen peroxide, magnesium peroxide, to give less toxic compounds—an organic base, that is, diethylamine, may be present.

Farbenindustrie, I. G. Manufacture of organic compounds of antimony. German Patent 493690, Feb. 25, 1927. Chim. et ind. vol. 24, No. 2, August, 1930, p. 368.

Diazoics are treated with Sb compounds in the presence of tertiary basis, such as pyridine or quinolin.

Guertler, W. Improvable and unimprovable silver alloys containing antimony. German Patent 497932, Oct. 26, 1927. Metals and Alloys, vol. 1, No. 13, July, 1930, p. 641.

Hall, A. E. Treating mixtures of alkali stannates, arsenates, and antimonates. U. S. Patent 1747709, 18.2.30, application 5.3.27. Chem. and Ind. (London), vol. 49, No. 38, Sept. 19, 1930, p. 862.

The alkaline slag obtained in the Harris process of lead refining is fused and poured in a thin stream into a saturated solution of sodium chloride containing sufficient sodium hydroxide to give d 1.4. The mixture is agitated at 90° and the hot, alkaline arsenate solution is separated by decantation from the insoluble residue of sodium stannate and antimonate. On cooling the solution trisodium arsenate separates and the mother liquor may be used again for leaching or evaporated to obtain a mixture of sodium hydroxide and chloride for use as a flux in refining further quantities of lead. The insoluble sodium salts are digested with hot water, which dissolves sodium stannate, and the insoluble sodium antimonate is washed, dried, and smelted to antimony. The stannate solution is agitated with powdered tin or treated with stannous salts to remove lead, copper, and arsenic, and the purified solution is electrolysed to obtain tin.

HEBERLEIN, CHARLES A. Separating arsenic, antimony, and tin from their mixed salts. U. S. Patent 1779272, Oct. 21, 1930, Chem. Abs., vol. 25, No. 1, Jan. 10, 1931, p. 176.

In separating Na stannate from a mixture with other salts including Na arsenate the mixture is treated with water in such quantity and at such temperature that only part of the Na stannate will dissolve to insure complete insolubility of the other salts.

KOHLMEYER, E. J. Method of separating zinc, tin, lead, bismuth, cadmium, antimony, arsenic and similar elements from sulphide ores or secondary products by means of blast smelting. British Patent 336670, July 19, 1929. Metals and Alloys, vol. 2, No. 1, January, 1931, p. 23.

MEYER, A. Recovery of antimony from residues. German Patent 456703, 20.1.26. Addition to German Patent 431984. Cf. British Patent 264139; B., 1927, 528. Brit. Chem. Abs. Chem. and Ind. (London), vol. 49, No. 10, Mar. 7, 1930, p. 199.

The method described in the prior patent is applicable to the recovery of antimony from ashes, residues, etc.; the material is fused with sulphur equivalent to the impurities present, whereby a crude regulus is obtained below a layer of matte.

PERKINS, M. F., HANSON, C. W., and O'HARRA, B. M. Process for treating mixtures of oxy salts of arsenic, antimony and tin. U. S. Patent 1756007, Jan. 20, 1927. Metals and Alloys, vol. 1, No. 13, July, 1930, p. 637.

ROSCHER, H. Refining antimony. U. S. Patent 1780944, Nov. 11, 1930. Eng. and Min. Jour., vol. 130, No. 12, Dec. 23, 1930, p. 617.

Method for refining antimony by electrolysis of an acid antimony trifluoride solution.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES[1] [2]

(MINE REPORT)

By J. P. DUNLOP

CONTENTS

	Page		Page
Summary	17	Review by States—Continued.	
Review by States	20	New York	21
Alabama	20	North Carolina	21
Georgia	20	Pennsylvania	21
Maine, Maryland, New Hampshire, and Vermont	20	South Carolina	21
New Jersey	20	Tennessee	21
		Virginia	23

SUMMARY

The mines of the Eastern States yielded metals in 1930 valued at $24,987,961, as follows: Gold, $46,637; silver, $47,582; copper, $4,970,164; lead, $836,700; and zinc, $19,086,878. The quantities of gold, silver, copper, lead, and zinc produced were greater in 1930 than in 1929, but owing to the lower prices of silver, copper, and zinc in 1930 the total values of those metals decreased.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

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[1] Work on manuscript completed July, 1931.

[2] Mineral Resources, 1908, Pt. I, pp. 645 to 681, contains references to the geology of the Eastern States and gives a list of the U. S. Geological Survey, State survey, and other publications that deal with the geology and mines of those States; Mineral Resources, 1911, Pt. I, pp. 139 to 163, contains a historical review of the production of gold in the Southern Appalachian States and a list of U. S. Geological Survey publications on gold, silver, copper, lead, and zinc in the Eastern States.

Mine production of gold, silver, copper, lead, and zinc in the Eastern States, 1921–1930

Year	Mines producing	Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
			Fine ounces	Value	Fine ounces	Value
1921	27	1,502,277	480.55	$9,934	98,792	$98,792
1922	29	2,274,175	620.22	12,821	80,935	80,935
1923	21	2,936,637	576.58	11,919	108,799	89,215
1924	16	2,851,932	799.88	16,535	97,628	65,411
1925	19	3,315,912	1,964.60	40,612	106,228	73,722
1926	21	2,902,670	694.23	14,351	106,539	66,480
1927	15	3,201,195	825.96	17,074	84,293	47,794
1928	21	3,770,070	1,697.82	35,097	102,520	59,974
1929	25	4,345,149	1,779.86	36,793	111,660	59,515
1930	24	4,160,831	2,256.06	46,637	123,590	47,582

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	15,397,596	$1,986,290	....	....	135,422,000	$10,521,030	$12,616,046
1922	15,476,497	2,089,327	1,472,000	$80,960	188,082,000	[1] 15,616,990	15,881,033
1923	20,487,395	3,011,647	2,500,000	175,000	199,180,000	14,765,885	18,053,666
1924	19,450,329	2,547,993	4,424,000	353,920	212,148,000	16,875,606	19,859,465
1925	20,824,058	2,957,016	5,354,000	465,798	226,814,000	18,531,644	22,068,792
1926	21,567,100	3,019,394	6,500,000	520,000	207,196,000	16,365,050	19,985,275
1927	22,327,734	2,924,933	4,786,000	301,518	236,340,000	16,836,647	20,127,366
1928	29,559,146	4,256,517	(2)	(2)	288,090,000	19,516,228	(2)
1929	34,045,920	5,992,082	(2)	(2)	309,096,000	21,920,456	(2)
1930	38,232,031	4,970,164	16,734,000	836,700	336,488,000	19,086,878	24,987,961

[1] Corrected figure.

[2] Bureau of Mines not at liberty to publish figures for lead.

GOLD AND SILVER

In the Eastern States the output of gold was $46,637 in 1930, compared with $36,793 in 1929. The gold lode mines and placer mines, which formerly yielded nearly all the gold, produced only 18 per cent of the total in 1930; no large properties were operated. Two gold lode mines produced 900 tons of siliceous ore yielding $6,740 in gold, and seven placer mines yielded $1,686 in gold. Placer mines were operated in Alabama, Georgia, and North Carolina and lode gold mines in Georgia and North Carolina. The increased output of gold in 1930 was largely due to increased recoveries from copper ore mined in North Carolina. Refining of copper bullion from ore mined in North Carolina, Pennsylvania, and Tennessee yielded $38,211 in gold, of which $10,800 came from North Carolina copper ore, $13,023 from Pennsylvania pyritiferous magnetite ore, and $14,388 from Tennessee copper ore. The copper ore mined in Vermont did not yield any gold. The value of the estimated output of gold in the Southern Appalachian States for the period 1799 to 1930 is recorded as $51,204,377.

Of the silver (123,590 ounces) produced in the Eastern States in 1930 all except 10 ounces from placer bullion and 70 ounces from lode gold mines was derived from copper bullion recovered from copper ore and pyritiferous magnetite ore. North Carolina and Tennessee mines produced most of the silver, and almost all the rest came from mines in Pennsylvania and Vermont.

Mine production of gold and silver in the Eastern States in 1930, by States

State	Gold		Silver		Increase or decrease in value as compared with 1929	
	Fine ounces	Value	Fine ounces	Value	Gold	Silver
Alabama	21.77	$450	3	$1	+$247	
Georgia	202.89	4,194	23	9	+1,620	
North Carolina	705.40	14,582	30,054	11,571	+9,528	+$322
Pennsylvania	629.98	13,023	5,762	2,218	−4,259	−965
Tennessee	696.02	14,388	83,640	32,201	+2,708	−11,122
Vermont			4,108	1,582		−168
	2,256.06	46,637	123,590	47,582	+9,844	−11,933
Total, 1929	1,779.86	36,793	111,660	59,515		

Mine production of gold and silver in the Eastern States in 1930, by sources, in fine ounces

State	Gold			Silver		
	Placers	Dry and siliceous ore	Copper ore	Placers	Dry and siliceous ore	Copper ore
Alabama	21.77			3		
Georgia	11.71	191.18		1	22	
North Carolina	48.08	134.87	522.45	6	48	30,000
Pennsylvania			629.98			5,762
Tennessee			696.02			83,640
Vermont						4,108
	81.56	326.05	1,848.45	10	70	123,510
Total, 1929	155.57	43.25	1,581.04	13	12	111,635

COPPER

The mine production of copper in the Eastern States in 1930 was 38,232,031 pounds, valued at $4,970,164, an increase of 4,186,111 pounds over 1929; most of the increase was due to larger shipments of copper ore from the Fontana mine in North Carolina. The output of copper was derived from copper ore mined in North Carolina, Tennessee, and Vermont and from copper concentrates recovered from Pennsylvania pyritiferous magnetite ore mined for its iron content. Exclusive of the magnetite ore, which yielded about 2.8 pounds of copper to the ton, the average yield of copper from copper ore was 1.93 per cent, or 38.6 pounds to the ton. The copper ore also yielded $0.08 in gold and silver to the ton. The copper concentrates from magnetite ore contained about 23.4 per cent of copper and $2.49 to the ton in gold and silver. Copper ore directly smelted amounted to 394,802 short tons, from which 23,491,231 pounds of copper were recovered. Copper and magnetite ores concentrated amounted to 1,521,880 tons and yielded 58,076 tons of concentrates, from which 14,740,800 pounds of copper were recovered.

LEAD

The output of lead from mines in the Eastern States in 1930 was from the Austinville mine in Virginia, the Balmat mine in New York, and the Embree mine in Tennessee. The production, which was much larger than that in 1929, came from lead-zinc ores.

ZINC

The recoverable zinc in the ore mined in the Eastern States in 1930 was valued at $19,086,878, a decrease of $2,833,578, although the quantity increased 27,392,000 pounds.

[N. B.—The value of the zinc in New Jersey is not that of ore mined. It is the estimated smelting value of the recoverable zinc content of the ore after freight, haulage, smelting, and manufacturing charges are added.]

In 1930, 690,348 tons of zinc ore were mined in New Jersey, and 270,601 tons of crude ore and old tailings were treated in New York. The ore mined in Virginia was all lead-zinc sulphide ore, except that of the Ivanhoe Mining & Smelting Co. All the zinc ore and lead-zinc ore mined in New York, Tennessee, and Virginia went to concentrating plants; part of the New Jersey ore was not concentrated. The recoverable zinc, as metal or in oxide, in the ore and old tailings from New York in 1930 was 44,942,000 pounds; Tennessee and Virginia contributed 96,294,000 pounds. Zinc concentrates shipped in 1930 amounted to 568,407 tons, of which 426,430 tons were from New Jersey and 44,570 tons from New York.

REVIEW BY STATES

Alabama.—The value of the gold produced in Alabama during the period 1830 to 1930 is recorded as $767,399. The only productive gold mine in 1930 was the Arbacoochie in Cleburne County, near Oxford, operated part of the year by A. H. Quinn.

Georgia.—The value of the gold produced in Georgia during the period 1830 to 1930 is recorded as $17,851,852, or more than one-third of the estimated total output of the Southern Appalachian States. In 1930 one placer mine and one lode mine yielded $4,194 in gold and 23 ounces of silver, compared with an output of $2,574 in gold and 16 ounces of silver from two lode mines and five placer mines in 1929. Very few gold properties in Georgia were operated in 1930; all the gold reported was from Lumpkin County. The Calhoun mine, which is equipped with a 10-stamp amalgamation mill, was operated part of 1930. A small output came from the Crown Mountain mine. Some development was done in 1930 at the Turkey Hill mine and other properties at Dahlonega. Dr. Craig R. Arnold, the owner of these properties, expects to operate them in 1931.

Maine, Maryland, New Hampshire, and Vermont.—No production of gold, silver, or copper was reported for 1930 from any of the mines in Maine, Maryland, or New Hampshire. The estimated total gold production of Maryland has been $71,405, virtually all of which was produced prior to 1906. The old Elizabeth copper mine and 400-ton flotation mill at South Strafford,[4] Orange County, Vt., were operated from January to June, 1930. The pyrrhotite and chalcopyrite ore body was mined through a 1,500-foot adit and a 900-foot inclined shaft. The copper concentrates, which contained about 2 ounces of silver to the ton, were shipped to Chrome, N. J.

New Jersey (see also note above).—The production of zinc ore in New Jersey in 1930 was 690,348 short tons; the ore contained 195,252,000 pounds of recoverable zinc. All the ore mined was treated by the producer for the recovery of metal and oxide.

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[4] Anderson, C. A., Vermont Copper Area: Eng. and Min. Jour., Mar. 9, 1931, pp. 208-209.

New York.—The quantity of ore mined in New York in 1930 was 210,599 short tons and old tailings re-treated, 60,002 tons; the concentrates recovered yielded 44,942,000 pounds of zinc. The Edwards property of the St. Joseph Lead Co. is equipped with a 500-ton all-flotation mill; the ore mined, a zinc sulphide, was taken from levels down to 1,500 feet. The Balmat mine of the St. Joseph Lead Co. near Sylvan Lake was also operated in 1930; this mine is opened by a 300-foot shaft and is equipped with a 500-ton flotation plant. The ore body at the Balmat mine is a zinc-lead sulphide; it yielded in 1930 a large output of both zinc concentrates and lead concentrates. Late in 1930 the St. Joseph Lead Co. began shipping its zinc concentrates to a new zinc smelter in Pennsylvania completed early in 1931.

North Carolina.—The value of the gold produced in North Carolina during the period 1799 to 1930 is recorded as $23,683,089. The yield of gold increased from $5,054 in 1929 to $14,582 in 1930. Placer mines and gold lode mines yielded only $3,782 in gold; the remainder was derived from copper bullion. The output of placer gold came from five small operations. In Burke County the Brindletown and Silver Creek properties yielded small outputs; in Franklin County the Centrifugal Recoveries Co. treated tailings and slimes from the Portis mine; in Stanly County J. H. Morrow recovered some bullion from the Fesperman placer; and in Gaston County small nuggets were picked up near Cherryville. Saprolites (Inc.) operated property in Montgomery County near Seagrove and made several shipments of bullion to the Philadelphia Mint. The North Carolina Flux Co. operated the old Cullowhee mine near East Laport in Jackson County and shipped considerable crude copper ore to the Tennessee Copper Co. smelter at Copperhill, Tenn.; the mine was closed in June, 1930. The Fontana copper mine in Swain County continued to ship crude copper ore to the Ducktown Chemical & Iron Co. at Isabella, Tenn. The copper bullion from this mine yielded most of the gold and silver credited to North Carolina in 1930. The lease of the Fontana Mining Corporation on this mine expired in February, 1931; the mine is now controlled by the North Carolina Exploration Co. The Rowan Corporation acquired the old Gold Hill mine in Rowan County in 1930 and did some prospect work preparatory to reopening the old workings and 40-stamp mill.

Pennsylvania.—The Cornwall mines in Lebanon County were continuously operated by the Bethlehem Mines Corporation and yielded 6,121 tons of copper concentrates from pyritiferous magnetite. The mine is operated by open pit and by means of shafts. The tailings from the iron concentrates go to the flotation plant. The copper concentrates, which contained about 23.4 per cent of copper and $2.49 to the ton in gold and silver, were shipped to the Nichols Copper Co. The silver content of the copper concentrates was less than 1 ounce to the ton.

South Carolina.—Mines in South Carolina yielded $5,182,815 in gold during the period 1829 to 1930. No output was reported for 1930, and no development work was done.

Tennessee.—Mines in Tennessee produced $349,381 in gold during the period 1831 to 1930. Most of the output prior to 1879 was from placer mines in Monroe County; however, these placers have been unproductive (except in 1928) for many years, and the gold output since 1906 has been almost entirely from copper ore mined in Polk

County. There were increases in the quantities of gold, silver, copper, and zinc in 1930, but the value of each of these metals except gold decreased. Lead also was produced in 1930, the first output since that in 1926.

Mine production of gold, silver, copper, lead, and zinc in Tennessee, 1921–1930

Year	Ore sold or treated	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1921	889, 122	$4, 920	98, 762	15, 084, 294		19, 384, 000	$3, 018, 756
1922	983, 844	4, 320	78, 341	14, 240, 571	1, 464, 000	31, 136, 000	3, 860, 410
1923	1, 355, 547	6, 615	105, 712	18, 721, 932	2, 500, 000	31, 800, 000	5, 182, 823
1924	1, 443, 159	6, 800	94, 779	18, 335, 635	1, 874, 000	28, 752, 000	4, 491, 070
1925	1, 711, 298	7, 421	102, 949	19, 788, 234	896, 000	32, 512, 000	5, 437, 660
1926	1, 114, 400	8, 622	104, 000	18, 606, 664	1, 600, 000	24, 196, 000	4, 621, 151
1927	1, 152, 155	8, 816	81, 460	14, 940, 595		20, 800, 000	3, 343, 421
1928	1, 330, 194	11, 117	75, 558	16, 374, 261		[1] 65, 834, 000	[1] 6, 429, 086
1929	1, 507, 980	11, 680	81, 281	(2)		[1] 81, 116, 000	(2)
1930	1, 499, 255	14, 388	83, 640	(2)	(2)	[1] 96, 294, 000	[1] 7, 421, 963

[1] Includes zinc from Virginia, for which Bureau of Mines is not at liberty to publish figures.

[2] Bureau of Mines not at liberty to publish figures for copper and lead.

The entire output of copper, gold, and silver in Tennessee in 1930 came from two properties in the Ducktown district.

The Tennessee Copper Co. ran its 900-ton flotation plant, 1,500-ton blast furnace, one converter, sulphuric acid plant, and copper sulphate works on sulphide ore from the Burra Burra and Eureka mines in Tennessee and the Cullowhee mine in North Carolina. Development of the Polk County mine began in 1929 and was continued in 1930 with encouraging results. The major development was sinking McPherson shaft from the eighteenth to the twentieth level. Ore reserves on January 1, 1931, were estimated at 6,034,148 tons, an increase of 254,589 tons. The experimental flotation zinc plant was operated in 1930, and a good quantity of concentrates averaging about 50 per cent of zinc was shipped.

The Ducktown Chemical & Iron Co. operated its flotation plant and blast furnace on sulphide ore and concentrates from the Isabella and Mary mines in Tennessee and on crude copper ore from the Fontana mine in North Carolina. The mine and smelter were operated all year.

The Universal Exploration Co. operated its old 100-ton plant on zinc carbonate ore in 1930 and completed its new 800-ton all-flotation plant. The zinc carbonate ore was taken from several shafts 30 to 60 feet deep, and the zinc sulphide ore was mined through two shafts 200 feet deep. The flotation blende concentrates produced at this property averaged more than 64 per cent of zinc in carload lots and were of higher grade than the zinc concentrates shipped from any other mine in the United States.

The Embree Iron Co. in Washington County continued to ship high-grade zinc carbonate and shipped also some lead carbonate concentrates. Fred Caldwell was also a shipper of zinc carbonate concentrates. Operations at the Mascot and Jarnegan mines of the American Zinc Co. of Tennessee were on a smaller scale than in 1929, owing to the decreased demand for and low price of zinc. There was little change in the mining development in 1930, and little prospecting was done at the Jarnegan mine. The Mascot 2,500-ton flotation-concentration plant was run mainly on ore from the Mascot No. 2 mine.

Virginia.—The value of the gold produced from mines in Virginia during the period 1828 to 1930 is recorded as $3,298,436, of which only about $9,200 was produced during the last 20 years. No production of gold has been reported from Virginia since 1926. The production of both lead and zinc increased in 1930. There were only one producer of lead and two producers of zinc, and the Bureau of Mines is not at liberty to publish the figures. Sulphide lead-zinc ore was treated by the Bertha Mineral Co. at its Austinville 1,500-ton mill, which ran all year. The Ivanhoe Mining & Smelting Co. produced some oxidized zinc ore from several shafts averaging 80 feet in depth. A 50-ton plant for the treatment of this oxidized ore is contemplated.

ARSENIC, BISMUTH, SELENIUM, AND TELLURIUM[1]

By V. C. Heikes[2]

CONTENTS

Page
Arsenic 25
Production and sales 25
Imports and exports 26
Market in 1930 27
Demand and supply 27
Prices 28
World production 28
Bismuth 29
Selenium 30
Tellurium 30

ARSENIC

PRODUCTION AND SALES

Production of arsenic as arsenious oxide in the United States in 1930 amounted to 17,057 short tons, of which 12,593 tons were refined and 4,464 tons were crude. All of the output was a by-product from smelting copper and lead ores. The products for the market consisted of refined white arsenic, crude white arsenic, "black" dust, "flue" dust, and "treater" dust. No production of red arsenic sulphide or elemental arsenic was reported.

A total of 17,425 tons of refined and crude arsenic, including 17,057 tons produced in 1930 and 368 tons from stock on hand, was sold; it was valued at $1,008,385, or 2.89 cents a pound. The refined white arsenic, 14,654 tons, was sold for $892,623, or 3.05 cents a pound; the crude arsenic, 2,771 tons, was sold for $115,762, or 2.09 cents a pound. Sales of crude and refined white arsenic by producers in the United States during the past 10 years are shown in the following table:

Crude and refined white arsenic sold by producers in the United States, 1921–1930

Year	Short tons		Value	
	Refined	Crude	Total	Average (cents per pound)
1921	3, 427	1, 359	$717, 700	7. 5
1922	8, 905	1, 122	1, 475, 229	7. 4
1923	12, 357	1, 914	2, 808, 801	9. 8
1924	12, 270	2, 183	2, 655, 015	9. 2
1925	11, 240	1, 077	1, 199, 247	4. 9
1926	10, 977	828	$674, 350	2. 9
1927	10, 020	1, 540	725, 360	3. 1
1928	8, 115	3, 652	735, 373	3. 1
1929	9, 823	4, 723	883, 771	3. 0
1930	14, 654	2, 771	1, 008, 385	2. 9

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[1] Work on manuscript completed August, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

IMPORTS AND EXPORTS

Arsenic compounds and metallic arsenic imported for consumption in the United States, 1921–1930

Year	Arsenious acid (white arsenic, As_2O_3)		Arsenic sulphide (realgar and orpiment)		Sheep dip		Paris green and London purple	
	Short tons	Value	Short tons	Value	Pounds	Value	Pounds	Value
1921	1,669	$253,270	3,343	$531,322	61,377	$6,362	325	$123
1922	1,081	162,494	3,815	472,044	70,390	4,877	3,866	741
1923	10,152	1,985,400	1,097	268,311	87,739	5,237	100,781	20,586
1924	8,877	1,597,433	234	45,246	114,801	10,764	76,241	15,683
1925	9,316	1,076,073	476	63,296	73,477	4,963	2,880	702
1926	7,703	510,227	283	40,718	119,947	14,070	4,747	1,011
1927	12,517	921,998	206	35,089	102,394	8,952	---	---
1928	11,153	775,169	263	51,278	175,055	17,592	13,279	1,497
1929	13,157	956,176	212	40,976	208,770	21,533	1,102	200
1930	10,471	725,991	277	47,235	174,215	18,517	19,024	1,595

Year	Arsenic acid (H_3AsO_4)		Calcium arsenate		Lead arsenate		Metallic arsenic	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1922 [2]	41,296	$4,195	---	---	---	---	22,487	$3,484
1923	166,354	15,597	---	---	26	$9	174,415	37,314
1924	420	121	3,172	$278	3,585	525	122,467	23,684
1925	59,112	2,676	1,074	135	10,467	1,514	149,018	31,918
1926	2,340	165	1,057	284	---	---	174,490	35,745
1927	11,685	470	3,807	717	---	---	245,686	47,875
1928	75	30	1,323	233	---	---	186,622	35,584
1929	247	26	---	---	200	26	287,545	50,730
1930	201	64	6,359	387	800	62	113,440	19,006

[1] Figures not available

[2] Figures cover period Sept. 22 to Dec. 31. Not separately classified prior to change in tariff.

White arsenic imported into the United States in 1930, by countries and districts

[General imports]

Country	Short tons	Value	District	Short tons	Value
Belgium	400	$27,130	Buffalo	588	$40,623
Canada	1,109	81,543	El Paso	679	27,176
France	27	1,761	Galveston	6	409
Germany	11	909	Hawaii	96	6,704
Japan	674	27,870	Los Angeles	20	1,232
Mexico	8,234	585,705	Maine and New Hampshire	(1)	48
Sweden	325	19,500	Maryland	169	8,792
			Michigan	377	29,971
			New Orleans	38	2,579
			New York	5,120	385,269
			Ohio	129	9,648
			Philadelphia	154	7,775
			San Antonio	2,792	192,514
			San Francisco	287	12,178
			Washington	325	19,500
	10,780	744,418		10,780	744,418

[1] 1,000 pounds.

Arsenic compounds exported from the United States, 1928–1930 [1]

Year	Calcium arsenate		Lead arsenate	
	Pounds	Value	Pounds	Value
1928	1,178,702	$67,151	1,093,673	$141,235
1929	3,139,633	171,123	1,563,982	192,185
1930	3,177,335	166,647	2,270,980	263,603

[1] Not separately recorded by the Bureau of Foreign and Domestic Commerce prior to 1928.

MARKET IN 1930

DEMAND AND SUPPLY

Arsenic as a by-product was produced and sold in 1930 by three smelting companies from current output and stock on hand. More than nine-tenths of this arsenic was recovered from the smelting of copper ores, and the remainder came from lead ores and iron concentrates. Montana and Utah ores were the chief sources of arsenic recovered at the smelting plants of the Anaconda Copper Mining Co., the American Smelting & Refining Co., and the United States Smelting, Refining & Mining Co. A more active inquiry for arsenic came from manufacturers of disinfectants and household specialties in 1930; planting areas, especially the Cotton Belt, made heavy demands.

Insecticide manufacturers were the largest consumers of the domestic supply, utilizing 70 per cent of the total output. Requirements for arsenic weed-killer and wood-preserver mixtures, made chiefly by western manufacturers, increased from 16 per cent of the total sales in 1929 to 19 per cent in 1930. The glass industry took half of its usual amount, representing 5 per cent of the total sales in 1930. Arsenic of the highest grade is usually sold to insecticide and glass manufacturers; crude arsenic, including "black" dust, "flue" dust, and "treater" dust, is used for weed-killer and for wood-preserving purposes. Other uses reported were purifying gas and refining cobalt.

Imports of crude and refined arsenic during 1930 amounted to 10,471 short tons. This, added to the 17,057 tons produced in 1930, indicates 27,500 tons as the approximate total new supply of white arsenic available.

Mexico was credited with 8,234 tons of the arsenic imported in 1930; the arsenic was produced at the by-product plants of the Mexican lead works of the American Smelting & Refining Co. and the American Metal Co. Canada exported to the United States 1,109 tons of white arsenic in addition to considerable arsenic contained in ores and concentrates shipped to smelters. Arsenical gold concentrates were also shipped from a gold mine in British Columbia to the Tacoma smelter in Washington. Alaska ores and concentrates treated at the Tacoma smelter yielded arsenic; this increased the domestic output. Most of the arsenic imported from Japan, third on the list of sources of imported arsenic, was recovered as a by-product from smelting copper ores. Belgium shipped to the United States 400 tons and Sweden 325 tons of arsenic. The imports from Sweden doubtless came from the recently completed Boliden smelter, the production of which is reported to be 10,000 tons of arsenic per year, at full capacity.

PRICES

The price quoted in New York for white arsenic delivered at the consuming point seems to have been uniformly 4 cents a pound for large lots, but small lots were quoted at a higher price. At 4 cents a pound the price includes freight from the refinery to the buyer's works and barreling; freight and barreling together averaged about 1 cent. These items account for the difference between quoted prices and the average value reported by the producers.

According to the Engineering and Mining Journal the English quotation for Cornish white was £15¾ to £16 a long ton during the first three quarters of 1930. On October 30 the price increased to £16 15s., with the Mexican product quoted at £17 c. i. f. Liverpool. The market gradually improved to the end of the year, and on December 25 London quotations stood at £18 10s. a long ton for Cornish white and £18 for the Mexican product.

Under the tariff act of 1930 arsenious acid or white arsenic continues on the free list.

WORLD PRODUCTION

World production of arsenic ore and white arsenic, 1925–1929, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country and product	1925	1926	1927	1928	1929
Algeria: Arsenate of lead—					
Gross weight	6,750	3,665	2,482	1,201	2,541
Arsenic content	1,148	733	546	144	305
Australia:					
New South Wales—					
Ore and concentrates	3,400	[1] 1,796	755	5,924	2,814
White arsenic	301	202	(7)	50	255
Queensland—Ore	1,133	828	71		
South Australia—Ore—					
Gross weight	102				
Arsenic content	(2)				
Austria:					
Ore[3]—					
Gross weight	89				
Arsenic content	15				
Arsenic content of gold ores	237	155	14		
Belgium: White arsenic	(4)	(4)	(4)	(4)	(4)
Brazil: White arsenic	(2)	51	(2)	(2)	(2)
Canada:					
White arsenic	910	1,807	2,220	1,821	1,678
Arsenic content of ores and concentrates[6]	648	495	605	645	694
China:					
Ore[5]	395	(2)	(2)	(2)	(2)
White arsenic[5]	94	(2)	(2)	(2)	(2)
Chosen: White arsenic	672				
Czechoslovakia: Ore—					
Gross weight	34	4	13	6	38
Arsenic content	(2)	1	3	1	8
France:					
Ore	30,349	23,256	56,822	69,362	47,296
White arsenic	2,217	2,096	2,456	2,947	(2)
Germany: Ore and concentrates[6]—					
Gross weight	6,626	3,930	4,710	4,373	4,454
Arsenic content	2,085	1,353	1,639	1,499	1,508
Great Britain:					
Ore	(7)		81		20
White arsenic and arsenic soot	2,586	1,693	1,358	1,314	968

[1] Exclusive of output of Ottery mine, data for which are not available.

[2] Data not available.

[3] Exclusive of arsenical gold ores worked primarily for their gold and silver content.

[4] Belgium reports production of white arsenic, but neither quantity nor value is stated.

[5] Exports.

[6] Data relate to concentrates produced and ore sold without concentration.

[7] Production reported, but figures not available for publication.

World production of arsenic ore and white arsenic, 1925–1929, in metric tons—Con.

Country and product	1925	1926	1927	1928	1929
Greece: White arsenic	423	1,148	1,036	709	763
Italy: Ore—					
Gross weight	4	200	81	--------	--------
Arsenic content	1	35	20	--------	--------
Japan: White arsenic	3,485	1,035	1,713	1,829	1,963
Mexico: White arsenic	7,507	6,445	11,332	12,933	[5] 9,665
Peru:					
Ore	(2)				
Arsenic	[8] 119	--------	--------	--------	--------
Portugal:					
Ore	76	7	47	(2)	9
White arsenic	1,092	354	(2)	134	105
Southern Rhodesia: White arsenic	170	49	38	102	52
Spain: Ore—					
Gross weight	--------	190	186	--------	--------
Arsenic content	--------	29	28	--------	--------
Sweden: Ore—					
Gross weight	110	13,149	22,100	22,728	22,919
Arsenic content	21	2,478	4,420	4,546	4,584
Turkey: Ore	--------	--------	--------	10	14
Union of South Africa: White arsenic	33	38	53	17	33
United States: White arsenic	11,174	10,709	10,487	10,675	13,196

[2] Data not available.

[5] Exports.

[8] White arsenic exported by the Anglo-French Ticapampa Silver Mining Co. (Ltd.).

BISMUTH

Bismuth was reported recovered at one refining establishment in the United States in 1930. Figures of production are not available for publication.

Bismuth and "compounds, mixtures, and salts of bismuth" imported for consumption in the United States, 1921–1930

Year	Bismuth		Compounds, mixtures, and salts of bismuth	
	Pounds	Value	Pounds	Value
1921	94,085	$114,891	(1)	(1)
1922	121,505	239,777	[1] 9,392	[1] $8,681
1923	62,640	146,178	11,731	13,717
1924	18,494	39,653	10,066	12,533
1925	99,694	187,340	16,983	18,958
1926	67,505	173,285	12,864	18,864
1927	47,732	100,773	10,560	15,080
1928	41,383	77,444	8,168	16,336
1929	37,480	58,853	3,552	16,645
1930	24,405	20,088	657	5,083

[1] Not separately recorded prior to change in tariff, Sept. 22, 1922.

The quoted price for bismuth at New York in ton lots was $1.70 ($1.85 and up for smaller lots) a pound during January, February, and the first three weeks in March. Free offerings of bismuth from Japan and Germany, with increasing production elsewhere, forced the trust to cut the price on March 20 to 5s. in London, equivalent to $1.20 in New York. The price remained at $1.20 ($1.35 and up for smaller lots) a pound in ton lots until May 28, when it was reduced to $1 ($1.15 and up for smaller lots). The price of $1 held until November 19, when it was advanced to $1.25. The closing price was $1.25 a pound in ton lots. In London the price during the first part of the year was 7s. 6d. a pound; the last week in March it was 5s. a pound for 5-cwt. lots or more; on May 28 the price fell to 4s. and remained there until November 19, when it advanced 1s. The closing price was 5s. a pound.

SELENIUM

Three companies reported an output of 454,769 pounds of selenium in 1930, compared with 516,298 pounds in 1929.

The annual sales of selenium from 1921 to 1930 are given in the table that follows.

Selenium sold by producers and in stock at producers' plants in the United States, 1921–1930

Year	Sales			Stock at end of year (pounds)
	Pounds	Value		
		Total	Average	
1921	55,978	$89,148	$1.59	
1922	123,565	177,542	1.44	
1923	127,174	237,196	1.86	677
1924	153,762	286,066	1.86	48,419
1925	194,007	330,637	1.70	61,775
1926	252,312	438,132	1.74	72,374
1927	284,508	491,996	1.73	158,494
1928	362,697	607,382	1.67	214,836
1929	344,288	568,265	1.65	391,033
1930	278,309	454,911	1.63	567,493

Selenium and selenium salts imported for consumption in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	1,106	$2,099	1926	18,885	$34,680
1922	1,652	2,530	1927	15,286	28,199
1923	940	1,653	1928	18,622	33,908
1924	300	606	1929	3,792	5,971
1925	5,807	10,682	1930	680	988

Quotations in New York for selenium (black, powdered, amorphous, 99.5 per cent pure) in 500-pound lots were $1.80 to $2 a pound. In London the price was 7s. 8d. to 7s. 9d. throughout 1930.

TELLURIUM

The total output of tellurium in 1930 was 14,095 pounds, compared with 11,410 pounds in 1929. The sales in 1930 amounted to 4,717 pounds, valued at $7,996, or an average of $1.70 a pound, compared with 1,309 pounds, valued at $2,710, or $2.07 a pound, in 1929. As in former years, a considerable quantity of tellurium in various forms was furnished gratis by producers to research workers seeking new uses for the element. These quantities are not reported as "sales."

MERCURY[1]

By PAUL M. TYLER[2]

CONTENTS

	Page
Statistical summary	31
Domestic production	31
Imports and exports	32
Markets and prices	35
Consumption and supply	37
Mining industry by States	39
Alaska	39
Arizona	39
California	39
Idaho	42
Nevada	42
Oregon	46
Southwestern region	46
South-central region	48
Southeastern region	48
Texas	48
Mining industry by States—Continued.	
Washington	49
Wyoming	49
World production	50
Foreign sources	50
Algeria	50
Australia	50
Canada	50
Colombia	51
Italy	52
Japan	53
Mexico	53
New Zealand	53
Peru	53
Russia	54
Spain	54

STATISTICAL SUMMARY

Summary of statistics for mercury in the United States, 1929 and 1930

[Flasks of 76 pounds]

	1929	1930
Production, flasks	23,682	21,553
Number of producing mines	63	75
Average price per flask:		
New York	$122.15	$115.01
London	£22 5s. 2d.	£21 15s. 8d.
Imports for consumption, pounds	1,133,721	283,086
Imports for consumption, equivalent in flasks	14,917	3,725
Apparent supply, flasks	38,500	25,200
From domestic mines, per cent	61	85
Stocks in warehouse (bonded) at end of the year, flasks	3,593	(1)

[1] Not yet available.

DOMESTIC PRODUCTION

The production of mercury in the United States in 1930 amounted to 21,553 flasks of 76 pounds each; the calculated value of this production, based upon the average New York quotation during the year, was $2,478,789. Due to the disturbed state of general business as reflected in occasional inability to dispose promptly of the product, shutdowns tended to interrupt production, and the quantity produced in 1930 was 9 per cent less than that produced by domestic mines in 1929. It was substantially greater, however, than in any year from 1919 through 1928. Moreover, the number of producing mines increased to 75 in 1930, from 63 in 1929 and only 13 in 1925. The mines producing in 1930 were distributed by States as follows: California, 40; Nevada, 20; Oregon, 7; Texas, 5; Washington, 1; Arizona, 1; and Alaska, 1.

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[1] Work on manuscript completed May, 1931.

[2] Unless otherwise stated, the statistics on the domestic industry in this report were prepared by H. M. Meyer and the data on imports and exports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines. E. P. Youngman, of the Bureau of Mines, assisted in assembling data from miscellaneous sources.

California was again the leading mercury-producing State in 1930, with an output of 11,451 flasks, and was the only important State, other than Texas, to increase its output. The number of operators in California increased from 29 in 1929 to 40 in 1930. Nevada, despite a decline in output of 31 per cent in 1930, retained second place. Its margin, however, over Oregon was rather small, notwithstanding a fairly large decrease in output from the latter State. Shipments from Washington also decreased. The output of Texas increased, but not enough to equalize the sharp drop in the Arizona output. Production from Texas, Arizona, and Alaska amounted to 2,822 flasks in 1930, as compared with 3,725 flasks in 1929. No mercury was reported as produced from pan-amalgamation tailings in 1930, whereas 171 flasks were recovered from this source in 1929 and 414 flasks in 1928.

Mercury produced in the United States, 1921–1930

	Producing mines	Flasks of 76 pounds	Value
1921	11	6,256	$300,595
1922	10	6,291	368,318
1923	14	7,843	521,302
1924	13	9,952	692,759
1925	13	9,053	752,616
1926	17	7,541	702,323
1927:			
California	9	5,672	670,217
Nevada	8	419	49,555
Oregon	3	2,055	242,761
Washington	1	559	65,996
Texas, Alaska, and Arizona	5	2,423	286,253
	26	11,128	1,314,782
1928:			
California	26	6,977	861,692
Nevada	17	2,867	354,061
Oregon	4	3,710	458,147
Texas, Washington, and Arizona	7	4,316	533,103
	54	17,870	2,207,003
1929:			
California	29	10,139	$1,238,428
Nevada	19	4,764	581,889
Oregon	5	3,657	446,084
Washington	2	1,397	170,637
Texas, Arizona, and Alaska	8	3,725	454,590
	63	23,682	2,892,628
1930:			
California	40	11,451	1,316,968
Nevada	20	3,282	377,460
Oregon	7	2,919	335,711
Washington	1	1,079	124,095
Texas, Arizona, and Alaska	7	2,822	324,555
	75	21,553	2,478,789

IMPORTS AND EXPORTS

The imports of mercury for consumption in 1930 were less than during any previous calendar year since 1913 and amounted to only 3,725 flasks, valued at $361,810, as compared with 14,917 flasks, valued at $1,513,197, in 1929 and a recent maximum of 25,634 flasks, valued at $1,784,250, in 1926. Exports of mercury have not been recorded separately since 1926, when they had dwindled to 114 flasks. Late in 1930, however, domestic miners would doubtless have been glad to sell a portion of their product at the export price level and some foreign sales may have been consummated.

Except for a much reduced importation of Mexican metal, the mercury imported was practically all from Spain.

Imports of mercury compounds, never large, were only half as much in 1930 as in 1929 and only about one-third of the quantity recorded for 1928.

Mercury imported for consumption in the United States, 1921–1930

Year	Pounds	Metric tons	Flasks (76 pounds)	Value
1921	795,078	360.64	10,462	$457,993
1922	1,269,004	575.61	16,697	757,842
1923	1,355,499	614.84	17,836	816,043
1924	987,719	448.02	12,996	566,820
1925	1,564,112	709.47	20,580	1,200,878
1926	1,948,170	883.68	25,634	1,784,250
1927	1,515,535	687.44	19,941	1,780,134
1928	1,106,736	502.01	14,562	1,437,153
1929	1,133,721	514.25	14,917	1,513,197
1930	283,086	128.41	3,725	361,810

Mercury imported into the United States, 1927–1930, by countries

[General imports]

Country	1927		1928		1929		1930	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Belgium			68,454	$93,823	94,969	$129,083		
Canada			5	10	37,500	52,195	5	$9
Chile	300	$490						
France					24,587	33,966		
Germany			40,954	57,414	53,259	70,677		
Hong Kong	5	6			3	4		
Italy	681,653	791,060	428,821	558,622	67,778	90,532		
Mexico	138,268	161,490	136,208	176,968	91,854	122,229	10,716	13,747
Netherlands	3,800	4,458						
Peru					960	700		
Spain	1,024,742	1,231,991	464,206	643,621	715,311	947,756	212,965	282,073
United Kingdom			30,100	41,559				
	1,848,768	2,189,495	1,168,748	1,572,017	1,086,221	1,447,142	223,686	295,829

Mercury compounds imported for consumption in the United States, 1929 and 1930

Compound	1929		1930	
	Pounds	Value	Pounds	Value
Chloride (mercuric) (corrosive sublimate)			46	$43
Chloride (mercurous) (calomel)	2,676	$4,355	1,875	3,262
Oxide (red precipitate)			10	21
Mercury preparations (not specially provided for)	3,298	6,360	1,248	2,451
Vermilion reds (containing quicksilver)	85,465	111,887	42,821	55,033
	91,439	122,602	46,000	60,810

Mercury exported from the United States, 1921–1930

Year	Pounds	Metric tons	Flasks (76 pounds)	Value
1921	29,501	13.38	388	$18,869
1922	21,834	9.90	287	15,910
1923	23,827	10.81	314	25,195
1924	15,581	7.07	205	14,333
1925	15,289	6.93	201	15,930
1926	8,668	3.93	114	10,319
1927–1930	(1)	(1)	(1)	(1)

[1] Not separately classified after 1926.

Since October 1, 1928, the Mercurio Europeo, a cartel formed by the Italian and Spanish producers, has been the leading factor in the world mercury market. The policy of this sales agency has been principally to sustain prices, and less rigid control has been exercised over production as stocks in both Italy and Spain have increased. The maintenance of high prices has likewise stimulated production in other countries, including the United States, and consequently the cartel's share of world business has declined. According to a statement credited to Die Metallbörse,[3] the members of the Mercurio Europeo had jointly produced 90 per cent of the world's mercury in some years prior to the formation of the cartel, and in 1928 their share was 82.9 per cent. In 1929, the sales of the cartel dropped to 80 per cent, and in 1930 they were only about 70 per cent of the total.

The real test of a cartel is found in its ability to deal with overproduction, or what is also described as underconsumption. Due chiefly to difficulties in regulating output, the international cartels concerned with various metals have one by one been disbanded or rendered inoperative. World stocks of mercury at the end of 1930 were equivalent to fully a year's supply (150,000 flasks or more), most of which was produced and not sold by the members of the cartel. In so far as it retained its stocks and sustained price quotations, the mercury cartel has withstood successfully the test of 1930 conditions. In so doing, however, it lost, at least temporarily, some of its dominance of the world market. Even in 1930, the cartel made a remarkably good showing considering world conditions. The reduction in the proportion of total sales made by the Mercurio Europeo raises the question, however, as to how much business the cartel can afford to lose before it may be tempted to retreat from its sustained price policy.

One important feature of the cartel's situation is that by far the largest gains in production have been made by mines operating within the United States, where at recent price levels the market has to a substantial extent been partly isolated as a result of tariff protection. In foreign markets, the position of the cartel has not been effectively challenged, and some observers declare that economic exhaustion of competing mines at a carefully considered price level is the key to the cartel's problems. Ore reserves in Spain alone are deemed adequate to meet the world's needs for many decades, and if the reserves controlled by the cartel outlast those of the rest of the world its control of the market would be tempered only by the possibility of substitution. On the other hand, some contend that new discoveries of ore and continued improvements in mining and metallurgical practice may maintain the flow of supplies from uncontrolled sources.

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[3] American Metal Market, Mar. 19, 1931, p. 3.

A certain element of strength in the present cartel is the small number of members and the further fact that governmental policies may check the natural desire for maximum immediate returns. Lack of complete agreement as to the allocation of production and sales quotas, however, is a common weakness of many syndicates and, apparently, one from which the Mercurio Europeo has not been wholly immune. In April, 1930, the cartel deemed it necessary to issue an official denial to rumors that it was about to dissolve. The statement contained the following forceful language:[4]

> There is no reason at all to advance that the Spanish Government should be against the Italo-Spanish agreement. The price fixed by Mercurio Europeo will remain unaltered, in accordance with its policy of stabilization, so much in favor with the real consumers. The exaggerated heavy stocks alleged to be in the hands of the associated Spanish and Italian mines, in no way influence the fixing of prices, the mines being able to sell only quantities that can be taken up by the market to cover the consumption.
>
> The mines have neither the intention nor the desire or possibility to sell separately, they being in a position to cover 95 per cent of the demand in mercury of Europe, Asia, and the Far East.
>
> We warn buyers against the maneuvers of some interested parties who wish, it seems, to adhere to them in the hope of again introducing in the commerce of mercury the former system of speculating, against which the organization of Mercurio Europeo arose, fixing a stable price for the longest period of time possible. Already, for the last 18 months the Lausanne limit has undergone no change.

Toward the end of the year, however, rumors of Spanish dissatisfaction still persisted and unofficial reports from Spain went so far as to state that the present agreement, which expires in 1932, may not be renewed.[5]

MARKETS AND PRICES

Opening the year at \$121-\$122 per flask, the price of mercury in New York City broke in March to \$117 and in April to \$112-\$114.

The closing of certain domestic mines permitted the market to work up to \$119 and even \$120 for spot metal in May and June, but in September there was another sharp break and in late September and October offerings were made at \$110. A more gradual decline to \$104-\$106 at the end of the year was continued further into the earlier months of 1931. Sales were reported as low as \$103 a flask. San Francisco prices are normally \$6 a flask lower than the New York market prices.

The prices quoted by the agents of the Mercurio Europeo remained at \$125, and the maintenance of this price was accompanied by a sharp drop in imports.

A sharp decline in the consumption of mercury in 1930, following a rapid increase of approximately 200 per cent in the production of American mines during the half decade 1926-1930, brought about a new set of market conditions, of at least temporary duration. In 1930 for the first time in many years the price of American-produced mercury fell below the European price plus the cost of importation.

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[4] Mining Journal (London), The Quicksilver Market: Vol. 169, May 3, 1930, p. 349.

[5] Stafford M. L., American consul, Madrid, The Mercury Mines at Almadén, Spain: Consular Rept. 13025, Dec. 29, 1930.

The end of the first three months of 1930 was marked by failure to maintain the New York price of domestic mercury at levels of the preceding year. Very early in the year American producers found themselves competing with one another. Domestic mines experienced considerable difficulty in disposing of their product despite the drop of importations to the 1913 level. Lack of market caused a number of shutdowns, some of which were of considerable duration, and new enterprises were discouraged by the gloomy aspect of the business and financial situation following the stock-market debacle of 1929. The decline of only 9 per cent in the output of domestic mercury in 1930 as compared with the output in 1929 represents surprising vitality in the face of the general business depression. The fact, however, should not be overlooked that the price maintained throughout the year by Mercurio Europeo influenced domestic production.

The Oil, Paint, and Drug Reporter describes the 1930 market for mercurials as follows:[6]

> Prices for mercurial preparations failed entirely to reflect the weakness in raw material. In fact, mercurials as a whole were stable almost throughout the entire year. Hard mercurials continued without change until December, when quotations were reduced conservatively. For example, calomel sold at $2.05 per pound until December, when the price was dropped to the basis of $2. Other hard mercurials were in identical position. Soft mercurials were without any change at all throughout the year. Blue mass brought $1.02 at all times and mercurial ointment, 50 per cent, sold at all times for $1.28. It may well be that the mercurial manufacturers in many instances were making their products from metal delivered to them by Mercurio-Europeo at the high price named by that company. A change in mercurial quotations may well develop once the domestic producers of same begin to secure their metal in the United States.

For several years prior to the formation of the Mercurio Europeo in 1928, the product of the Almadén mines in Spain was distributed by a company known as Compañia Española del Mercurio. Formerly the Rothschild interests acted as selling agents. Changes in the market flow of mercury are thus described in a Canadian review:[7]

> When the contract for the sale of the product of Spain with a leading British firm was in force the bulk of the Spanish output was brought to London and thence distributed to all parts of the world. The leading firm has in the past held many thousands of bottles in London, and it has distributed these supplies in quantities ranging from 2 to 500 bottles, according to the requirements of consumers. Stocks are still held in London, but a large proportion of the supplies are now sent direct from Spain and Italy to all parts of the world, although the dealings are largely transacted in London. Regular channels of trade are not readily closed, and there are indications that firms throughout the world will continue to look to London for their supplies.

Prices of domestic mercury at New York, 1926–1930, by months[a]

[Per flask of 76 pounds, except as indicated]

Month	1926[b]	1927[b]	1928	1929	1930	Month	1926[b]	1927[b]	1928	1929	1930
January	$87.96	$101.20	$123.62	$119.48	$121.19	July	$90.16	$119.88	$121.26	$121.65	$117.46
February	87.58	101.73	121.37	119.82	120.50	August	89.26	119.11	124.50	125.11	116.00
March	88.19	110.26	122.56	121.90	118.81	September	91.43	119.64	128.00	124.54	113.62
April	89.77	123.25	123.74	122.00	114.00	October	97.26	126.20	125.92	124.30	110.60
May	91.37	123.90	123.17	121.15	117.27	November	99.00	127.71	123.00	123.32	106.72
June	91.35	118.10	122.42	120.50	118.60	December	99.51	126.93	122.50	121.95	105.35

[a] Engineering and Mining Journal.
[b] Price quoted on 75-pound flask prior to June, 1927.

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[6] Oil, Paint, and Drug Reporter, extra edition (Annual Market Reviews): Vol. 119, No. 9, Feb. 26, 1931, p. 69.

[7] Canadian Mining Journal, The London Quicksilver Market: Vol. 51, No. 35, Aug. 29, 1930, p. 847.

Average yearly prices of mercury in the United States and the United Kingdom, 1917–1930

[Per flask of 76 pounds, except as indicated]

Year	San Francisco (domestic)[1]	New York[2]	London[3]			Year	San Francisco (domestic)[1]	New York[2]	London[3]		
			£	s.	d.				£	s.	d.
1917[4]	$105.32	$106.30	22	4	3	1924[4]	$68.69	$69.76	11	19	8
1918[4]	117.50	123.47		(5)		1925[4]	82.67	83.13	13	17	1
1919[4]	90.29	92.15	20	9	5½	1926[4]	91.60	91.90	15	13	6
1920[4]	79.66	81.12	20	14	9	1927	117.61	118.16	21	7	11
1921[4]	47.42	45.46	11	3	5	1928	[6]125.34	123.51	22	6	1
1922[4]	57.78	58.95	11	11	6	1929	[6]124.00	122.15	22	5	2
1923[4]	65.68	66.50	10	4	9	1930	(7)	115.01	21	15	8

[1] Mining and Scientific Press, San Francisco. } Eng. and Min. Jour.-Press, 1922–1925; Eng. and Min.
[2] Engineering and Mining Journal, New York. } Jour., 1926–1930.
[3] Mining Journal (London).
[4] Price quoted on 75-pound flask prior to 1927.
(5) Quoted as "nominal" only.
[6] Beginning Oct. 27, 1928, quotations for San Francisco are on basis of "retail and small wholesale lots."
(7) Not given.

CONSUMPTION AND SUPPLY

Supply of mercury in the United States, 1921–1930

[Flasks of 76 pounds]

Year	Production	Imports for consumption	Exports	Apparent supply		
				Total	From domestic mines	Imported
	Flasks	*Flasks*	*Flasks*	*Flasks*	*Per cent*	*Per cent*
1921	6,256	10,462	388	16,330	35.9	64.1
1922	6,291	16,697	287	22,701	26.4	73.6
1923	7,833	17,836	314	25,355	29.7	70.3
1924	9,952	12,996	205	22,743	42.9	57.1
1925	9,053	20,580	201	29,432	30.1	69.9
1926	7,541	25,634	114	33,061	22.5	77.5
1927	11,128	19,941	(1)	[2]30,900	35.5	64.5
1928	17,870	14,562	(1)	[2]32,300	54.9	45.1
1929	23,682	14,917	(1)	[2]38,500	61.3	38.7
1930	21,553	3,725	(1)	[2]25,200	85.2	14.8

(1) Not separately classified after 1926.
[2] Estimated by Bureau of Mines.

No important new uses of mercury were reported in 1930, but the feasibility of the use of mercury in power generation was successfully demonstrated, thus creating a relatively new outlet for substantial sales of the metal during the next few years. William LeRoy Emmet, a research engineer of the General Electric Co., first proposed utilizing mercury vapor instead of steam and eventually built an experimental machine. He succeeded in interesting the Hartford (Conn.) Electric Co., which in 1923 installed a 5,000-kw. unit in its Dutch Point station. After working successfully for a time, a boiler head blew out and thousands of dollars worth of mercury was lost. Despite this experience, the same company proceeded to build a larger unit of 10,000 kw. capacity at its South Meadow plant. This new unit, which was started on February 4, 1930, exhibited marked economy in fuel consumption and complete absence of vibration and proved easy to start and operate. Maintenance costs, it is believed, will be less than for standard steam plants, and the new unit has produced as high as 143 kw. h. of energy for each 100 pounds of coal burned, as compared with a maximum of 112 kw. h. and an average of about 59 kw. h. per 100 pounds of coal in steam-power plants owned by American public utilities companies.[8]

A 20,000-kw. mercury-vapor turbine generator is to be installed by the General Electric Co. in a new power plant at Schenectady, where the South Meadow unit was built. This second installation is to be twice as large as the first and will be even more efficient due to increased pressure and temperature. Still a third unit, even larger than the second, was under construction early in 1931 at Kearny, N. J., and the annual report of the Public Service Corporation and subsidiary stations (issued in February, 1931) announced that a 75,000-kw. unit will be installed at the Kearny station next year. The total capacity of the mercury turbines and the auxiliary steam turbines operated with steam produced in the mercury-vapor condensers will then be approximately 95,000 kw. at this one plant.

Translated into mercury requirements, these new installations represent a significant market factor. The mercury in the boiler now operating at the South Meadow plant in Hartford amounts to approximately 2,380 flasks. The Schenectady unit, although twice as large, does not require twice the quantity of metal, but the estimated needs are 250,000 pounds or 3,290 flasks. For the first Kearny unit 270,000 pounds[9] or 3,550 flasks are needed. These two installations, therefore, constitute a demand for more than 6,800 flasks, worth around $750,000. This quantity represents more than one-fourth of the apparent domestic consumption of the metal in 1930 and practically one-fifth the total requirements in less abnormal years.

To avoid the high initial investment required for the mercury-steam cycle, a German engineer, Dr. Ing. E. Koenemann,[10] has proposed a binary power-generation cycle employing ammonia and an ammonia carrier in the primary stage and steam in the secondary stage. The key to the process is a property of the zinc-ammonia compound, $ZnCl_2.2NH_3$, which loses 1 molecule of ammonia at high temperatures while the resulting $ZnCl_2.NH_3$ vigorously takes up a molecule at a lower temperature. The first effect requires the addition of heat (endothermic) and the recombination gives off heat (exothermic). In a typical case the di-ammonia salt is melted in a boiler and gives off ammonia at 100 pounds per square inch absolute pressure and 896° F. The ammonia gas produces power in a turbine, whence it is exhausted at 1 pound absolute pressure and 239° F. to a jet-condenser "mixer" where it recombines with the ammonia depleted salt which meanwhile has been cooled in a heat exchanger. The heat of the reaction is used to generate steam and the recombined compound is returned to the boiler. Doctor Koenemann's calculations indicate a fuel saving of more than 29 per cent and a reduction in cooling water of 40 per cent, as compared with a simple steam cycle.

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[8] American Metal Market, Public Service to Install Mercury Vapor Power Unit: Feb. 26, 1931.

[9] Parsons, A. B., The Drift of Things: Min. and Met., vol. 12, May, 1931, p. 249.

[10] Chemical and Metallurgical Engineering, vol. 37, No. 12, December, 1930, p. 758. Abstract of Article in Power, Oct. 28, 1930.

MINING INDUSTRY BY STATES

ALASKA

Mercury developments in Alaska during 1929 have been reviewed as follows:[11]

> It is currently reported that at the Parks property, lying north of the Kuskokwim River, between Georgetown and the mouth of the Holitna River, a small amount of quicksilver was mined and the metal recovered in a crudely built homemade furnace that was in operation for about two weeks. The owner reports that he expects to start up more extensive developments at this place early in the season of 1930. Most of the quicksilver from this property is sold to the placer mines in the Iditarod district or the near-by parts of the Kuskokwim Valley. In the Bluff district of Seward Peninsula there was some activity during the year in prospecting and development work on one of the old lodes on Swede Gulch near the town of Bluff that carries some quicksilver. Several claims are included in the tract on which most work is being done, and some veins were uncovered that encourage further search. The ore is said to be on the whole of low grade, but the tenor is believed by the owners to be high enough to pay for mining if there is any considerable quantity of ore. At this property two men were employed in the underground developments. It is reported that work will be continued here on a small scale as long as the showings continue to be encouraging. A lode carrying quicksilver ore is reported to have been found in the Livengood or Tolovana district, on the ridge at the head of Olive and Lillian Creeks. A tunnel 300 feet long, from which a shaft 100 feet deep has been sunk, was driven to prospect the deposit. The ore is said to carry considerable gold in addition to the quicksilver.

ARIZONA

G. M. Magnuson remodeled the mill at the Sunflower mine, Tonto Basin district, Maricopa County, with a view to starting operations early in 1931. The property is equipped with a 4 by 60 foot Gould rotary furnace and an 8-tube Johnson-McKay retort. The Dreamy Draw mine in the Winifred district of the same county, operated by E. W. Hartman for the Quicksilver Corporation of America, yielded a considerable tonnage of low-grade ore, some of which was run through the 35-ton Cottrell rotary furnace on the property. In Gila County, the Reynolds mine was abandoned after resampling, and consequently the Quicksilver Co. of America was dissolved. The Arizona Quicksilver Corporation installed a new condensing system. The Mercury Mines of America was reported idle.

CALIFORNIA

In 1930, as in former years, California led the list of mercury-producing States. It furnished 53 per cent of the total output in 1930, as compared with 43 per cent in 1929 and 83 per cent in 1925.

Fresno County.—The Archer mine, located in 1904, owned by Joseph Byles & Sons and leased to Charles McWaters, was being equipped with a 20-ton rotary furnace in 1930. The Mercy mine, acquired under a foreclosure sale in March, 1929, by Wm. R. Biaggi, was also producing in 1930. Work was being resumed at another old property, the Mexican mine in the Coalinga area.

Kern County.—At the Cuddeback mine, 12 miles north of Tehachapi, the Santa Ana Mining Co. (C. D. Holmes, president) built a 100-ton concentrating plant to recover tungsten and gold values as well as cinnabar.

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[11] Smith, P. S., Mineral Industry of Alaska in 1929: U. S. Geol. Survey Bull. 824—A, 1930, pp 79–80.

Lake County.—The various properties in Lake County were described in considerable detail by Averill.[12]

Methods and costs of recovering mercury from low-grade ore at the reduction plant of the Sulphur Bank Syndicate, Clearlake, Calif., are discussed in Information Circular 6429, Method and Cost of Recovering Quicksilver from Low-Grade Ore at the Reduction Plant of the Sulphur Bank Syndicate, Clearlake, Calif., by Worthen Bradley, recently issued by the Bureau of Mines (Feb., 1931, 17 pp.).

The ore, which occurs as a surface deposit covering about 100 acres to a depth of 5 feet, was originally worked for sulphur. Cinnabar finely disseminated in a gangue of altered basalt and minor amounts of opal are associated with the sulphur. The ore as a whole contains only about 2 pounds of mercury per ton; but as the cinnabar occurs mostly in the fines, the ore can be enriched by screening and hand-sorting until it will assay 8 pounds of mercury per ton or better, when it is considered furnace ore.

Methods of recovering the mercury are as follows: (1) Screening and sorting the low-grade ore to obtain a furnace feed; (2) treatment of the ore in a rotary kiln; (3) precipitation of the dust carried from the furnace in a gas stream; (4) condensing quicksilver from the gas stream as (*a*) high-grade mud and (*b*) low-grade mud; (5) flotation treatment of low-grade mud to obtain high-grade concentrates; and (6) drying and retorting high-grade condenser mud and flotation concentrates to make a finished product.

Among prospective developments may be mentioned the probable installation of a furnace on the Konocti property of John L. Jago in 1931. Operations of the United Mercury (Inc.) at the Helen mine were tied up by financial difficulties. At the Bonanza King, Arthur Copsey was engaged in cleaning out an old tunnel and starting a new tunnel to hit the ore 75 feet lower.

Monterey County.—The Bibby Consolidated Mining Co., organized to take over the Patriquin mine, came into production early in 1930. The property was previously equipped with a 50-ton Gould furnace and other improvements. Dr. W. K. Chambers is president and Peter Buol is manager for the company.

Napa County.—The Acme Mines & Mill (Inc.) (H. W. Gould, president) worked the Oat Hill and La Joya mines during 1930, and the Lucky Strike Mining Co. (B. C. Austin, president) also operated on these same properties under a sublease. The latter company is reported to have struck a good body of high-grade ore in its tunnel at the old Oat Hill mine, but after mining a considerable quantity of ore (treated in the Acme company's furnace) the Lucky Strike Mining Co. relinquished its lease upon the Oat Hill property as part of the purchase price for the La Joya mine. Considerable development work was done at this property also, but it reverted to the Gould interests at the end of the year. The old Aetna mine, also in the serpentine belt of northern Napa County, which was reequipped in 1929, was abandoned and the operating company was dissolved in 1930. H. W. Gould & Co. completed the installation of a 3 by 40 foot rotary furnace and a cast-iron condensing system at the Bella Oak mine, about 1 mile from Napa, and subsequently operated the property under an arrangement with the Bella Oak Mines Co. The Knoxville mine, 48 miles from Napa (nearest railroad point), was a large producer of mercury prior to about 1883 and between 1893 and 1918 was credited with an output of 120,987 flasks. There was a small production in 1922 and the property was reequipped in 1927; the 3-foot furnace on this property was operated by George E. Gamble in 1928, 1929, and 1930.

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[12] Averill, C. V., Mining in California: Rept. 25 of the State Mineralogist, vol. 25, No. 3, July, 1929, pp. 350-364.

San Benito County.—The new 800-ton screening plant and steel picking belt were put into service at the New Idria mine (described in the 1927 chapter of this series). Other producing mines were the Aurora and Stayton, the latter owned and operated by R. B. Knox. Prospecting at several other properties in this county was reported as encouraging.

San Luis Obispo County.—On April 1, 1930, the Consolidated Metals Corporation (H. W. Klipstein, president) took over the well-known Oceanic mine under lease and bond from H. W. Gould & Co. The Mercury Corporation of America (Ltd.), S. S. Rapp, manager, was rebuilding its plant at the Rinconada mine which, except for the furnace, was destroyed by fire on October 31, 1930. The property which is also known as the San Jose Valley mine is separate from the Oceanic district, being situated 11 miles southeast of Santa Margarita.

Santa Barbara County.—The James H Townsend syndicate was engaged in building trails, clearing out old tunnels, and other preliminary work at the Los Prietos group and at the Donner Extension claim in the upper Santa Ynez River country.

Santa Clara County.—E. T. Haun, who was working over the dumps of the New Almaden, transferred his activities to Trinity County in 1930 and Benj. Black treated dump material from this famous old mine during the year. About 6 miles to the east, at East Almaden, the California-Nevada Quicksilver Mining Co. (Otto Taubert, president and manager) was developing the Coyote mine where a considerable body of good ore is reported to have been opened up—a quantity sufficient to encourage consideration of the installation of a furnace. This deposit and five others, reported upon the 1,600-acre property included in the same lease, are on the serpentine belt which contained the New Almaden. Workings include a 400-foot tunnel driven to connect with a 100-foot shaft. The Piercy property was worked in a small way by the Santa Clara Quicksilver Corporation, the ore being treated in the 12-tube retort on the property. A number of other properties in the New Almaden district and vicinity were prospected.

Sonoma County.—The Nevada Quicksilver Mines (Inc.), L. A. Friedman, president, successful operators in the Antelope Springs district of Nevada, purchased the Cloverdale and Baumeister (Buckeye) properties, comprising 400 acres. This purchase is described in the November, 1930, report of the company to stockholders,[13] from which the following statement is extracted:

> Your company purchased the Cloverdale and Baumeister mines on August 21, 1930, and has been operating them since that time, most of the efforts being

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[13] Denver Mining Record, Nevada Quicksilver Mines Co. Makes Good Report on New Property: Vol. 40, No. 45, Nov. 8, 1930.

> directed towards development work, although there has been a profitable production made in the mill at the same time. * * *
>
> On the Baumeister property, which was virgin territory, we exposed an ore body on the surface, which was at that point approximately 20 feet in thickness, and the length of which has as yet not been ascertained but which from appearances is going to be very great. This ore body we have now cut by a tunnel 160 feet long, and at that point we reached the vein and are now crossing through the vein at a right angle with a 45° upraise, which up to yesterday had reached a length of 34 feet of exceptionally good ore. * * *
>
> The old method of bringing these ores to the mill by leasers who had been doing some work on the properties was very expensive, costing from $1 to $1.50 a ton. Consequently we made a contract on the twenty-fourth of last month with the Painter Tramway Co., of San Francisco, to install an aerial cable tram, which is contracted to be in operation within 60 days; and with that we can deliver the ore from the mine into the bins for something between 4 and 5 cents a ton. * * *
>
> At the Cloverdale mine, which is the adjoining property that we purchased, we have been devoting our time in cleaning out and repairing the old tunnels, which were run from 20 to 30 years ago, at which time quicksilver was selling for less than one-third of its present price * * * and nothing but an extremely high-grade ore could be handled at a profit. * * *
>
> During the past 10 days we have purchased all the necessary supplies for a complete overhauling and repairing of our present 100-ton plant. * * * It is also our intention to add the first 100-ton unit to our milling capacity as soon as the installation of the aerial tram is completed.

Stanislaus County.—During the summer, the Covert mine of the Orestimba Mining Co. was acquired by the Vulcan Gold Mines Co., which proposed to equip the property with a new furnace and necessary machinery early in 1931.

Yolo County.—The Reed mine (originally the California) in the Knoxville district, southwest of Rumsey, is credited with producing 5,653 flasks between 1876 and 1880, when the surface plant was destroyed by fire. A small quantity of mercury was recovered from the brick and mortar of the old furnaces in 1914–15, but with this exception the property has remained idle. In February, 1930, however, it was reported that the Tonopah North Star Tunnel & Development Co. and the Myra Mining Co. (L. E. Browne, president) had begun work. A 900-foot tunnel, 50 feet below the old workings, was said to be in good ore.

IDAHO

In the Yellow Pine district of Valley County, Idaho, the United Mercury Mines, an enterprise backed by the F. W. Bradley interests, continued its extensive development campaign. The company applied to the Federal Power Commission for a license to develop power on the east fork of the south fork of the Salmon River. It proposes to build a concrete diversion dam, a 2-mile flume, and a power house whence a 3-mile transmission line will carry the current to the mining and milling operations.

NEVADA

The newly developed mercury-mining industry in Nevada suffered more severely in the depression than the industry in other large producing States. This was due partly to a reduction in the flow of new capital as a result of the general tightening up of funds in investment and speculative markets in the East following the stock-market crash beginning in October, 1929. At least one operator, however, deliberately curtailed production in the belief that more remunerative prices might be obtained later. Nevada production in 1930 amounted to 3,282 flasks, a reduction of 31 per cent as compared with the preceding year. Even the reduced 1930 output, however, represents a favorable showing in comparison with the output in 1926, when the State produced less than 200 flasks.

The leading producers in 1930 were the B. & B. Quicksilver Co. and Red Rock Quicksilver Co., both in Esmeralda County; the Raymond Van Ness Mining Co., in Nye County; the Nevada Quicksilver Mines (Inc.) and Pershing Quicksilver Co., both in Pershing County; and the Castle Peak Quicksilver Co., in Storey County. Descriptions of several of these properties have appeared in previous chapters of this series, and the geology and commercial developments of most of the more important deposits have been covered recently by Schuette.[14]

Elko County.—A 20-ton Newhall rotary furnace, formerly known as the Andrews furnace, was installed at the Ivanhoe or Mayflower mine, and the Newhall interests produced mercury in this area (14 miles southeast of Midas) until weather conditions caused a temporary shutdown in November. The California-Nevada Quicksilver Mining Co. (Otto Taubert) abandoned its claims. The Goldfield Consolidated Mines Co. was engaged in prospecting, as was R. H. Williams (Amexco mine, near Ivanhoe). Noble Getchell, manager of the Gold Circle Consolidated Mines, about 15 miles northwest of Ivanhoe, leased the Elko Prince mine to Victor Jacobsen, Oscar Berg, and Charles Lyons, former employees of the company, according to report.

Esmeralda County.—Installation of the new rotary furnace and Diesel power plant of the B. & B. Quicksilver Co. was completed in January, 1930, but due to the necessity of relining the old furnace and making changes in the condensing system the plant was not operated to capacity until the summer. In August, although both furnaces were in operation, the output had not come up to the mark because lower-grade ore was being treated. At the beginning of the year the former manager of the company, E. J. Bumsted, estimated reserves at 200,000 tons of ore containing 5 pounds or more of metal to the ton and a total perhaps of 500,000 tons, provided 3-pound material could be classed as ore. In July, a considerable body of 10-pound ore was reported as developed at the lower end of the property, below the furnace level. Walter T. Childers became manager of the property in August.

The Red Rock Mining Co., about 10 miles southeast of the B. & B., added new equipment and contemplated the installation of Diesel engines to supplant the present gasoline power. Conditions at the mine were reported as satisfactory, but marketing difficulties developed during the summer and resulted in a temporary shutdown. In the Montezuma district, 19 miles from Goldfield, J. P. Sweeney and Harry McMillan, Nevada Cinnabar Mines (Inc.), developed 20 feet of furnace ore in a tunnel. The deposit is of the hot-water type, similar to the B. & B., and is said to be extensive. Within a mile of the Cuprite-Stonewall Mountain road, George Smith and William Byers of Goldfield are reported to have driven a 300-foot tunnel in ore-bearing formation.

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[14] Schuette, C. N., Occurrence of Quicksilver Ore Bodies: Am. Inst. Min. and Met. Eng., Tech. Pub. 335 (Class I, Min. Geol. 31), July, 1930, 88 pp.

Humboldt County.—Considerable development and prospecting was under way in 1930.

Lander County.—Schuette[15] calls attention to an interesting occurrence in the Ruby group of claims, about 55 miles south of Battle Mountain, where cinnabar is found in leached pockets in the conglomerate over a wide area. As the region is without water and is about 18 miles from a railroad, this prospect has not been operated recently.

Mineral County.—Active prospecting continued in the Dunlap Canyon district with generally favorable results, and a considerable quantity of ore was mined and treated (mostly in retorts). Childers and Rudolph worked on various properties and produced metal from the Leighton property (Reward group), which was later leased to G. M. Smith, who proposed to install gravity concentrating equipment. The Drew-Bugg mine, idle for several years, was leased to Ingalls and Schmidt, who retimbered the shaft, cleaned out the old workings, and retorted some metal. The property, discovered by Towner and Ott in the Pilot Range between the Drew-Bugg and Betty mines, was worked by Henry D. Ott, who reported opening a substantial body of high-grade ore, much of it said to average 12 per cent, and specimen ore reported to run up to 40 or 50 per cent of mercury. A Schuette retort was ordered. A placer deposit, 400 to 600 feet wide with a 16-foot run of high-grade ore, is reported by George Chrysler in the Pilot Range, 22 miles east of Mina; samples were said to run as high as 40 or 60 per cent of mercury. J. R. Towner proposed to start development upon his claims, situated about 3 miles from the Ott property. What apparently represents still another new strike was announced as claims were staked by Clyde Garrett, W. W. Stockton, Bennie Hood, Bob Hart, and J. A. McLaughlin near the Nye County line. Mercury is said to occur in an andesite belt, 300 feet wide, and a sample across a 40-foot trench averaged 5 pounds to the ton. Near the Esmeralda County line, at the Red Rose mine, the Mount Montgomery Quicksilver Co. reported 10,000 tons of furnace ore developed in September, 1930.

Nye County.—The Raymond Van Ness property, opened late in 1928, was equipped with a 20-ton Gould rotary furnace which was operated 160 days, starting in July. Peter Buol, who with Van Ness organized the company, is manager, but Van Ness is reported to have sold his interest to William Geffrey of Los Angeles. The ore is generally high grade and occurs in a lime and shale belt, 250 feet wide and lying between granite on the north and slate on the south (the south contact being well defined). At the Salt Lake Mercury mine near Ione, M. P. Doonan, superintendent, recommissioned the 50-ton Scott furnace and the mine came into production. The deposit, a rhyolite replacement, is developed by a tunnel which connects with a 50-foot glory hole, and a 65-foot winze sunk below the floor of the tunnel is said to be in ore. The retort furnace at the Golden Fleece mine, also near Ione, was operated by Glen B. Mills. In the extreme northwestern part of Nye County, John Vargas and A. Basquez located cinnabar in opalite, 6 miles southeast of Eastgate (Churchill County) on the Lincoln Highway.

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[15] Schuette, C. N., Work cited, pp. 12-13.

In the vicinity of Belmont in the Toquima Range, J. A. McLaughlin, of the Kernick Divide Mining Co., reported signs of cinnabar over a wide area, but prospecting is proceeding slowly owing to the rugged character of the terrain. Near the Lincoln County line, Jesse Mellan operated two D-retorts on selected high-grade ore. Assessment work was done on various other properties.

Pershing County.—Operations at the Pershing Quicksilver Co. mine were suspended for several months pending disposition of unsold stocks of metal. The Nevada Quicksilver Co. paid a stock dividend of 15 per cent on outstanding shares on August 19, 1930. Operations by the company were continued in the Antelope Springs district, including the Mammoth or Montgomery mine purchased in 1929, and a new high-grade strike was reported on its Juniper property; the Cloverdale mercury mine in California was also acquired during the year. Under a 3-year lease-and-option agreement, J. W. Hall (manager), L. C. Newton (president and secretary), and Sam Jay equipped and began production from claims owned by the Antelope Springs Mercury (Inc.), 25 miles east of Lovelock and adjacent to the Juniper property. Several hundred tons of 1 per cent ore were said to be already broken. Good showings were reported in a 350-foot tunnel and shaft by the Cinnabar King Mining Co. (George S. Clack, president) which has 7 claims in the Antelope Springs district. At the Cole property an 800-foot tunnel was being driven through shale and sandstone to investigate a limestone contact.

Storey County.—The Castle Peak Quicksilver Co. mine, 9 miles from Virginia City, has become one of the most profitable and productive in Nevada. Development began in the spring of 1928, and the following year a 3 by 40 rotary furnace was installed. According to the report of the company, production from September 5, 1929, through September 30, 1930, was 1,028 flasks, sold for $118,035.50, or an average of $114.82 per flask, f.o.b. Pacific coast. Cost of production was reported as $53.86 per flask, and gross profits were $62,661, out of which $16,000 of indebtedness was paid off and $38,125 was disbursed in dividends. The average yield per ton of ore treated was 8.89 pounds. The extent of the ore is not yet known, but a large tonnage has been blocked out within an area 34 by 60 feet and to a height of 38 feet above the main tunnel. A shutdown was caused by severe freezing weather in the fall of 1929; from June 16 to July 13, 1930, the plant had to be closed again to permit the installation of a new cast-iron condensing system. This change was made necessary because of an increasing percentage of iron sulphide in the ore. Late in the year H. E. Loufek, president and manager of the company, was reported to have said that only low-grade ore was being put through the furnace, reducing the output to 3 flasks per day, as 100 flasks shipped to San Francisco were still unsold. The following description is from the Nevada Mining Press of August 1, 1930.[16]

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[16] Nevada Mining Press, Castle Peak Quicksilver Mine Opens New Body High-Grade Ore: Vol. 12, No. 531, Aug. 1, 1930.

> The Castle Peak quicksilver mine * * * is developing a new ore body a thousand feet north of the glory-hole deposit, which bids fair to produce a large tonnage of high-class furnace ore. Occupying the position of a flat bed at the surface, dipping into the mountain at an angle of about 20°, it is approximately 8 feet wide and averages around 10 pounds of mercury per ton of ore, a good furnace grade.
>
> The Castle Peak mine is operated through a tunnel, which enters the hill back of the furnace plant. * * * To the left and about on a level with the water tanks above may be seen a white dump, from a shaft that is being sunk to cut the new ore body on its dip and determine its extent.
>
> The ore was first discovered 50 feet to the left of the shaft, in the Bendixen cut. This cut struck the ore and was changed to an incline tunnel, which followed the ore for about 30 feet. From the adit a drift was advanced south toward the shaft for a short distance. This work was discontinued in favor of sinking because of the difficulty of getting the broken rock out. Should the ore body prove to be worth while, a drift will be driven north from the transportation tunnel to get beneath it. * * * The big ore body, over 40 feet wide, strikes east of north and extends into the mountain. The mill tunnel cuts the formation 500 feet north of the glory hole.
>
> This adit is now being advanced to strike the ore channel far into the hill. Mineralization shows in the face, and the tunnel should cut the channel within 100 feet or less if it continues on its course. In the glory hole the ore makes on both sides of a well-defined break in the andesite. Ore from the glory-hole workings and a wide stope beyond is dropped through chutes to the drift connecting with the mill tunnel and trammed to the bin at the top of the furnace building.

Washoe County.—The Steamboat Springs mercury mine has been leased to Balfour, Guthrie & Co. (Ltd.) of San Francisco and will be operated henceforth for glass sand and kaolin as well as for mercury. According to Schuette[17] the cinnabar at this property was originally deposited in granite, which has been decomposed so that practically only the silica remains. The ball mill and flotation machinery, described in the 1928 chapter of this series, have been supplemented by additional washing equipment, completed in August. The cinnabar and a small quantity of kaolin are readily removed by attrition, which leaves a high-grade silica sand. The lease calls for a royalty on all three products, that on mercury being on a sliding scale of valuations between $70 and $100 per flask. The sands are mined by power shovel from an open cut and hauled to the mill bins by gasoline locomotives. The washing plant has a capacity of 300 tons a day.

OREGON

The principal mercury deposits so far discovered in Oregon lie in the southeastern part of the State, in Malheur County, on the Oregon-Nevada line; in the southwestern part, in Curry, Lane, Douglas, and Jackson Counties; and in the south-central part, in Lake County.

SOUTHWESTERN REGION

In southwestern (or western) Oregon, the deposits are in three chief areas: (1) That including the Blackbutte mine, a deposit at Elkhead, the Non Pareil and Bonanza mines, and a prospect at Glide (mostly in Douglas County but partly in Lane County); (2) that extending from the vicinity of Tiller, Douglas County, southeastward 40 or 50 miles to a point beyond the Rogue River at Trail (Jackson County); and (3) a small area on Evans Creek, known as the Meadows district (Jackson County).

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[17] Schuette, C. N., Work cited, p. 15.

Blackbutte mine.—The Blackbutte mine of the Quicksilver Syndicate, to which is credited most of the production in western (or southwestern) Oregon, is 17½ miles south from Cottage Grove, Oreg., in T. 23 S., R. 3 W. It is in an east-west spur of a ridge on the north slope of the Calapooia Mountains, a range connecting the Cascade and Coast Ranges. The deposit is large and carries a little gold, but it is distinctly low grade. It is owned and operated by the Quicksilver Syndicate. According to Pardee:[18]

> Parts of the Blackbutte zone rich enough to be workable under present conditions are as much as 40 feet wide and hundreds of feet in their other dimensions. It is understood that the average content of the ore mined in 1929 was between 4 and 5 pounds of quicksilver to a ton. The mine workings aggregate several thousand feet, and all of them are accessible from adit levels. The equipment includes two rotary Gould furnaces, which have a combined capacity of 200 tons a day.

Non Pareil and Bonanza mines.—These two mines, discovered in 1865, lie 8 miles east of Sutherlin, Oreg., and 6 miles slightly south of the town of Oakland, the northern mine being the Non Pareil, the Bonanza lying a little west of it. Both occur in the same dike of altered andesite.

In the Non Pareil mine, 2,000 feet or more of adits and connected workings exist. The ore from a stope 4 to 15 feet wide, 75 feet long, and 150 feet deep (pitch length) is reported to have been treated in a Scott furnace and to have yielded 700 flasks of mercury. The indicated content of the ore is 7 pounds to the ton.[19]

The Bonanza mine was worked several years ago and the ore treated in a Scott furnace, but its exact output is not known. Several hundred feet of workings turned from adit levels explore the lode to a maximum depth on the dip of 230 feet. Visible specks of cinnabar are sparingly scattered through the mass, and hundreds of samples taken throughout the workings are said to show an average of 3 pounds or more of mercury to the ton.

Tiller-Trail area.—Samples from the Tiller-Trail prospects indicate a mercury content of 2 to 20 pounds or more to a ton, but the extent of the ore bodies is not known. These prospects are mostly on crushed and altered zones in volcanic rocks, probably of Tertiary age. The cinnabar is sparingly and irregularly disseminated through the zones in streaks and specks. The zones, some of which are 30 feet or more in width, show "iron ribs" similar to those in the Blackbutte deposits and the Bonanza areas.[20]

Meadows district.—Of the several mines in the cinnabar-bearing deposits of the Meadows district, the largest, the War Eagle mine, was operated intermittently before 1920, producing, it is reported, 556 flasks of mercury. The ore bodies, 4 to 6 feet wide, extend several hundred feet along the strike and dip. The extracted ore averaged 1 per cent or more of mercury.

The older workings of the Dave Force mine (belonging to the Quicksilver Producers Co.) contain ore bodies in the form of pipes a few feet in diameter, which extend obliquely along the lode. The ore from these bodies, several of which have been exploited, is comparatively rich. It was treated in retorts. The newer workings of this mine expose a tabular body (6 feet wide in one place) that contains films and streaks of cinnabar.[21]

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[18] Pardee, J. T., Deposits of Gold, Copper, Quicksilver, and Associated Metals in Western Oregon: U. S. Geol. Survey press release, Aug. 7, 1930.

[19] Pardee, J. T., Work cited.

[20] Pardee, J. T., Work cited.

Pardee describes the Meadows district as follows:

> The quicksilver deposits in the Meadows district occur in zones of fracturing that cross a variety of rocks, including andesite tuff, sandstone, shale that contains coaly layers, and intrusive granite and porphyry. Within these zones and immediately adjacent to them the rocks have been more or less altered by hydrothermal solutions and partly replaced by chalcedonic quartz. Veinlets and specks of cinnabar accompanied by more or less pyrite and marcasite are irregularly disseminated through the zones.

SOUTH-CENTRAL REGION

Lakeview, Lake County.—At the close of the year (1930) it was reported that development of a deposit of cinnabar near Lakeview, by a western company, was under way. The property of the Goose Lake Gold Mining & Milling Co., near Willow ranch, has been leased, with option to buy, and a working crew was busy on the site of the old gold operations stripping the heavy ledge of cinnabar; the cinnabar is said to be of very high grade. The development is under the direction of Oscar J. Streeter, of Nevada.

SOUTHEASTERN REGION

The Opalite cinnabar mine of the Mercury Mining Syndicate (owned by the F. W. Bradley interests of San Francisco), one of the most important mercury mines of Oregon, was reported early in 1930 to be almost exhausted, but later very low-grade ore was being put through the furnaces; it was thought that a profit could be made even upon this poorer ore, as the plant and the management of the mine are good, the glory-hole method of mining is cheap, and the mercury is in opalite, which breaks well with a small amount of powder. The 1927 chapter of this series describes this mine, the mining methods employed, and the plant and equipment.

TEXAS

The mercury-mining industry of Texas was active in 1930. The Chisos mine continued to be the principal producer. Frank Duncan reported good results from prospecting during the year, although much of the surface ore developed was a little too low in grade to put through retorts. Retorts of the Rainbow Mines (Inc.) were operated during the year; a small Herreshoff furnace was installed and came into operation in January, 1931. Brewster Quicksilver Consolidated operated the properties of the Texas Almaden Mining Co. and the Big Bend Cinnabar Mining Co., at Study Butte. On the Big Bend property there is a 30-ton rotary furnace and a 12-tube Johnson-McKay retort for treating soot. On the Texas Almaden property the Scott furnace was operated for part of the time.

All these mines are in the Terlingua district, Brewster County, and most of the shipments are made by way of Alpine or Marathon, about 90 miles distant; the district was described in the 1927 chapter of this series. In Uvalde County, Binnie and Layton opened up a mercury prospect 28 miles south of Uvalde but reported no production.

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[21] Pardee, J. T., Work cited.

WASHINGTON

During the summer of 1930 the Consolidated Mercury Mining Co. was constructing a 100-ton Herreshoff furnace to treat cinnabar on its properties (consisting of more than 1,100 acres) in the Morton district, acquired from the Barnum McDonell Mercury Co.[22] The first shipment from the new plant was reported early in 1931. The Morton Cinnabar Co. produced 1,079 flasks of mercury in 1930 from its mine in the same district.

The mercury-mining area of the Morton district has been described by Schuette as follows:[23]

> There is a quicksilver-mining district around Morton, some 67 miles south of Tacoma, Wash. The two mines active in 1928 were the Morton Cinnabar Co. and the Barnum McDonnell mines. The properties adjoin and are on the same ore occurrence. The mineralized area, of which these two mines form the center, extends about 3 miles northwest-southeast and perhaps 2 miles northeast-southwest. The rocks in the district are feldspathic tuffaceous sandstones and sandy shales containing organic matter. Some of the rocks are derived from pyroclastics, such as volcanic ash and breccias. These country rocks were intruded by andesite and basalt now greatly altered.
>
> The strike of the ore occurrence is N. 17° to 18° W., and the dip is from 26° to 45° W. A section through the Morton company's ground is given in Figure 9*d*. No. 3 level is the main haulage level and is run on the contact of an altered andesite (?) and a tuffaceous sandstone-shale series. There has been sufficient movement along this contact to make a gouge, and apparently the movement was north in the east and south in the west sides of the contact. In the upper workings a thrust fault has displaced the contact some 60 to 70 feet toward the west. A gouge of black sandy material 4 inches thick was formed along this fault plane. The ore has formed under these gouges, which constitute the hanging wall. Toward the footwall the ore grades off. Counting both mines, ore has been developed on the strike for a distance of over 800 feet. Locally, where favorable conditions for concentration are found under shale strata, high-grade pockets are formed. One mine stopes a furnace ore; the other selects retort ore. In depth, ore has been found down to 400 feet thus far. The McDonnell mine on its lower level has a small seam of coal interstratified with the sedimentaries. At this point, cinnabar, pyrite, and coal occur together. Here is an opportunity for geologists who advocate a magmatic origin of bituminous matter in quicksilver deposits to enlarge upon their theory and include coal deposits.
>
> On the Morton company's ground a northeast-southwest fracture dipping south has been worked. Toward the east on the strike of these workings a dike shows on the surface. The intersection of this fracture with the fault on which the main workings are located is looked upon as promising ground.

WYOMING

In the 1929 chapter of this series reference was made to a large area in Fremont County that was reported to contain native mercury distributed through the alluvials. In April, 1930, it was reported that E. F. Fader (agent for Walter Gordon Clark, of Los Angeles, who has the option, lease, and bond on properties under the control of the Mountain Development Co.) was engaged in core drilling and otherwise investigating the commercial value of the extensive deposits, known as the Bonneville placers, near Shoshoni.

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[22] Engineering and Mining Journal, Build New Quicksilver Plant in Morton District: Vol. 129, No. 9, May 8, 1930, p. 479.

[23] Schuette, C. N., Work cited, pp. 49–50.

WORLD PRODUCTION

World production of mercury, 1926–1930, by countries

[Compiled by L. M. Jones, of the Bureau of Mines]

[1 metric ton = 29.008 flasks of 76 pounds]

Country [1]	1926		1927		1928		1929		1930	
	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons
Algeria	75	2.6	29	1.0	--------	--------	122	4.2	325	11.2
Austria	171	5.9	160	5.5	133	4.6	113	3.9	72	2.4
Bolivia [2]	--------	--------	--------	--------	46	1.6	49	1.7	--------	--------
Canada	6	.2	--------	--------	--------	--------	--------	--------	--------	--------
China	[2] 58	[2] 2.0	[3] 2,147	[3] 74.0	(4)	(4)	(4)	(4)	(4)	(4)
Czechoslovakia	2,387	82.3	1,601	55.2	2,086	71.9	1,897	65.4	2,060	71.0
Italy	54,274	1,871.0	57,900	1,996.0	57,677	1,988.3	57,906	1,996.3	56,069	1,932.9
Japan	--------	--------	--------	--------	14	.5	41	1.4	(4)	(4)
Mexico	1,317	45.4	2,353	81.1	2,535	87.4	2,396	82.6	4,821	166.2
New Zealand	--------	--------	20	.7	--------	--------	--------	--------	52	1.8
Rumania	58	2.0	104	3.6	--------	--------	--------	--------	(4)	(4)
Russia [5]	3,678	126.8	2,147	74.0	2,950	101.7	3,481	120.0	(4)	(4)
Spain	46,244	1,594.2	72,316	2,493.0	63,675	2,195.1	71,832	2,476.3	19,221	662.6
Turkey	160	5.5	--------	--------	87	3.0	235	8.1	537	18.5
United States	7,541	260.0	11,128	383.6	17,870	616.0	23,682	816.4	21,553	743.0
	115,969	3,997.9	149,905	5,167.7	147,073	5,070.1	161,814	5,578.3	107,000	3,700.0

[1] In addition to the countries listed, Chosen and Taiwan report production of cinnabar in 1929 as follows. Chosen, 506 kilograms; Taiwan, 27,979 kilograms. Mercury content not stated.

[2] Exports.

[3] Production as reported by Geological Survey of China.

[4] Data not available.

[5] Year ended Sept. 30.

FOREIGN SOURCES

ALGERIA

Moderately extensive deposits of cinnabar have been described from time to time as existing at Ras-el-Ma in the Department of Constantine, about 25 kilometers from the port of Philippeville, the concession covering an area of 1,336 hectares along the road from Bône to Constantine. In 1929, Algeria produced 122 flasks of mercury, and according to reports in the European press new equipment was being installed in 1930 with a view to increasing the output to about 3,000 or even 6,000 flasks, thereby making France virtually independent of outside supplies of the metal.

AUSTRALIA

A prospecting party, searching for mercury deposits in the vicinity of the Watson River, returned with a small amount of high-grade cinnabar float which was definitely traced to a lode.[24]

CANADA

Except for small amounts produced from a deposit near Kamloops Lake in British Columbia in 1895–1897 and again in 1926, Canada has not been a source of mercury, although numerous showings of cinnabar have been noted, especially in British Columbia and Ontario. Early in 1930, it was rumored that ore assaying approximately 50 pounds of mercury per ton had been opened up in the Sudbury district in Ontario. Further information as to this rumored discovery has not been forthcoming.

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[24] Queensland Government Mining Journal, Mining in Queensland. Other Minerals: Vol. 31, No. 359, April, 1930, p. 143.

COLOMBIA

Codazzi,[25] relating the history of mercury mining in Colombia, notes that native mercury, described by the German savant Karsten, at El Boquerón, above Bogotá, was probably derived from amalgam, stolen in transit to the mint and distilled by improvised methods in caves. In 1886 old Spanish workings were discovered in the Sierra Quindío near Tolima and a mercury-mining company was organized to open the Bermellón mines, references to which were found in documents and communications addressed to the Spanish king about 100 years earlier. As samples showing up to 30 per cent of mercury were found, metallurgical equipment was installed and roads were built; altogether a considerable amount of money seems to have been spent, before work was finally abandoned early in the nineteenth century, without very substantial results as regards actual production of metal. Cinnabar was found later in the region of Manizales (Caldas) and in Alto de Ginja, district of Retiro (Antioquia), but in amounts too small to encourage exploitation; in the Calarcá district equipment was installed on the basis of showings which subsequently proved to consist of realgar (arsenic sulphide) and not cinnabar as had been reported by an unscrupulous assayer.

Geological conditions in the mines of Bermellón are described in the following (condensed) translation:

> The Bermellón cinnabar mine is situated in the region of Quindío, of the Cordillera Central, in the Porvenir ranges, between the Anaime and Bermellón Rivers, at an altitude of 3,000 meters above sea level.
>
> The narrow veins ("agujas") which constitute the mine are formed in green schists or shales. These schists, of pre-Cretaceous age, are chloritic and micaceous; occasionally they contain sufficient carbonaceous material to cause a black lustrous appearance, which results in the miners giving them the name of "Negro-negro." The country rock is much crumpled; the veins follow the undulations and often are attenuated so that the ore appears only in small lenticular masses.
>
> Two eruptive formations cross the schists, displacing them and probably contributing to the folding. The volcanic formation of the axis of the fold of the cordillera is composed of andesite, dacite, and other similar rocks; the Plutonic formation, which begins in Payandé and continues to the region of Anaime, is composed principally of syenite, monzonite, and amphibole granite. In the neighborhood of Porvenir, however, this rock takes on a marked porphyritic character, and the material that has been injected into the schists might be classified as porphyry in the east and as porphyrite in the west. The surface is for the most part covered by volcanic ash and cinder.
>
> The veinlets have a general direction of north to south or northeast to southwest. The gangue is calcite, "brown spar" (carbonate of calcium, magnesium, and iron), and quartz with minor amounts of albite, muscovite, black tourmaline, pyrite, and gray copper. The ore mineral is cinnabar, which occurs in veins, grains, or lenticular masses, always associated with quartz and calcite.
>
> The analysis of the ore from a narrow fissure vein, made by Pereira Gamba, is as follows:

	Per cent
Silica	12.0
Calcium carbonate and oxide of iron (calcárea y oxido)	6.7
Mercury	69.8
Sulphur	11.4
Loss	.1
	100.0

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[25] Codazzi, Ricardo Lleras, The Mercury Mines in Colombia: Boletín de Minas y Petróleo, vol. 3, No. 13, Depto. de Minas y Petróleo del Ministerio de Industrias, Bogotá, January, 1930, pp. 35-37.

This exceptional richness (nearly 70 per cent) leads one to believe that the analysis was of selected samples. The assay reported by Dr. Scheibe for an average sample of the diffused (impregnado) mineral was only 27 per cent. (See Memoranda Concerning a Deposit of Cinnabar in Tolima, in the documents of the National Scientific Commission.) The miners took care to select cinnabar of the average (grade) of the exploitable ore and found, by this method, that as a general rule the ore contained 30 per cent of cinnabar, which gives a richness of mercury very similar to that found by Dr. Scheibe.

ITALY

In 1930, Italy produced 1,932.9 metric tons of mercury, compared with 1,998.3 tons in 1929. In 1929, as in former years, about three-fourths of the total came from the Firenze district, including the Italian Provinces of Grosseto and Siena, and the remainder from the Trieste district in the former Austrian Province of Gorizia. The grade of the ore mined in the Trieste district was a trifle lower in 1930 than in other recent years, whereas that from the Firenze district was higher. The capital of the Società Anon. Mineraria Monte Amiata was increased in 1930 from 32,400,000 to 48,600,000 lire, the reason[26] given for the increase being the necessity of maintaining a stock of metal as well as providing for the future.

Preliminary figures for the first six months of 1930 indicate that exports in 1930 were larger than in 1929, although still far below those in 1928. Germany was the principal destination for exports of mercury from Italy, Japan ranking second. The United States, formerly the best customer for Italian metal, was out of the market, but business with the Far East was a little better and there was marked improvement in the demand from France. Shipments to the United Kingdom increased greatly as compared with 1929 but amounted to scarcely one-half those recorded in 1928.

Mercury produced in Italy, 1928 and 1929

Province	Ore mined						Metal produced				
	Number of mines	Number of workmen	Metric tons	Tenor (per cent)	Value [a]	Tons per man	Number of plants	Number of workmen	Flasks (76 pounds)	Value [a]	Flasks per man
1928											
Gorizia (Trieste)	1	832	81,721	0.703	$1,043,966	98.22	1	136	14,368	$1,380,090	105.65
Grosseto	7	485	46,479	.540	338,026	95.83	3	173	5,541	582,382	32.03
Roma	1	11	740	.600	6,613	67.27					
Siena	4	1,058	115,709	1.119	3,361,675	109.37	3	500	37,768	3,969,952	75.54
	13	2,386	244,649	.868	4,750,280	102.54	7	809	57,677	5,932,424	71.29
1929											
Gorizia (Trieste)	1	821	79,635	.674	1,076,079	97.00	1	132	13,129	1,347,518	99.46
Grosseto	10	534	49,799	.400	365,960	93.26	4	181	5,665	561,956	31.30
Roma	1	11	117	.600	1,010	10.64					
Siena	6	1,065	110,080	1.237	3,341,358	103.36	3	463	39,172	3,886,893	84.60
	18	2,431	239,631	.884	4,784,387	98.57	8	776	57,966	5,796,367	74.70

[a] Lire converted to dollars at the average annual rate of exchange, as published by the U. S. Federal Reserve Board.

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[26] Mining Journal (London), The Italian Quicksilver Market: Vol. 171, Nov. 8, 1930, p. 882.

JAPAN

Yamato Suiginzan Kogyosho continued to produce mercury on a small scale at Osawa, Japan, throughout the year.[27]

MEXICO

In 1927, the Mexican production of mercury jumped to 2,353 flasks, from 1,317 flasks in the previous year. After maintaining this higher rate for two years Mexico more than doubled its output in 1930, when a production of 4,821 flasks (166.2 metric tons) was reported, or even more than the 1918 peak during the war boom. Production was slow during the early months of 1930, but rehabilitation of the Castro and Huitzuco mines was started in the fall, and toward the close of the year the Castro mine alone was producing from 250 to 300 flasks per month.[28]

At the twelfth ordinary general meeting of the Mexican Corporation (Ltd.) in London in December, 1930 (Mining Journal, London, December 13, 1930, p. 969), the chairman announced that the Fresnillo Co. (a subsidiary owned by 50 per cent of stock) acquired a 60 per cent interest in the Compañia Minera de San Jose, S. A., owning and treating a patio tailings deposit about 6 miles east of Fresnillo. This deposit is estimated to contain at least 330,000 dry tons, averaging 0.02 ounce of gold, 4.4 ounces of silver, and 1.37 pounds of mercury per ton. The capacity of the lixiviation plant is about 5,000 tons per month. Working costs are low, and at present prices for silver and mercury a profit is indicated of about $1.50 per ton. The plant was started in December, 1929.

NEW ZEALAND

In 1930, Kaikohe Development (Ltd.), the subsidiary of the Imperial Chemical Industries (Ltd.), which has been engaged in prospecting and construction for several years, completed the erection of its plant which includes four rotary furnaces with a rated capacity of 400 tons. The property is in the Ngawha Springs area, North Island, and comprises 65 acres on which five separate deposits were reported as discovered. The ore is cinnabar with a certain amount of native mercury and was described as averaging 4½ to 5 pounds per ton. According to Gould,[29] however, this property has been closed down.

PERU

In early mining days when gold and silver ores were universally amalgamated, the great cinnabar mines of Huancavelica produced the major part of the world's mercury. As low-grade deposits in Peru are probably not worked out, Peru may again produce the metal if prices continue at high levels.

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[27] Gould, H. W., Quicksilver: Eng. and Min. World, vol. 2, No. 2, February, 1931, p. 84.

[28] Gould, H. W., Work cited, p. 84.

[29] Gould, H. W., Work cited, p. 84.

RUSSIA

Mercury is included in the long list of items, the production of which is to be stimulated in the U. S. S. R. At present the only mercury deposits exploited in Russia are those at Nikitovka in the Donetz Basin. In the fiscal year 1928-29 these deposits, estimated to contain more than 8,300 tons of mercury metal,[30] yielded 120 metric tons, compared with only 29 tons in 1913. It is proposed, during 1931, to increase the capacity of this plant to 375 tons annually and by 1932 to 750 tons, or about 22,000 flasks. New deposits of mercury and antimony have been discovered in Central Asia, and mercury occurrences have also been found recently in Turkmenistan and in Siberia. Credits have been granted by the Government for further exploration of these deposits.

The deposits in Central Asia, one of which alone is estimated to contain at least 10,000 tons of mercury, have been described as follows (translated from Izvestia, November 22, 1930) by the Russian section of the United States Bureau of Foreign and Domestic Commerce.[31]

> The Pamir (Tadzhik) expedition organized by the Soviet Academy of Science, as well as a surveying party of the nonferrous metal division of the Supreme Economic Council, have discovered in Central Asia two regions which have large deposits of mercury ores. One of them is located on the territory of the Turkmen Republic of Soviet Russia, near the Persian border; the other is located in Southern Fergana, at the junction of the borders of the three Central-Asiatic Republics. The latter deposit is found to be the richer. It extends over an area of 200 kilometers, lying on the northern slopes of the Altai Mountains. These deposits are found there sometimes on the crests of mountains and sometimes in the valleys. Some of them have been worked by the Chinese since time immemorial. However, the Chinese have extracted only an insignificant part of the deposits. The richest deposit is located near a small Kirghiz village, Khaydarkan, which is located only 75 kilometers from the city of Fergana. At this place the bed is near the surface and contains more than 1 per cent of pure mercury, which is considered very high, because Americans are known to work on mercury ores with only a 0.3 per cent content of pure metal. Only one district has been so far surveyed and the mercury deposits there, according to the most conservative estimates, are placed at 10,000 tons. The rich contents of this ore, easy mining conditions, and the presence of transport facilities make this deposit particularly valuable.

SPAIN

The Spanish mercury mines have been worked more or less continuously since the Roman occupation of the peninsula and they still constitute the world's principal reserve of the metal. Due to the heavy accumulation of stocks, estimated at 100,000 flasks, the Almadén mine was closed down in February, 1930, but it was reopened in October. At the close of the year it was reported that between 5,000 and 6,000 flasks were being produced monthly and that 1,500 men were employed, about three times as many as in 1929. Exports apparently were lower than during any previous year since 1924. Shipments to Great Britain (some of which may have been reexported to other countries) increased slightly as compared with 1929, but exports to all other destinations (especially to the United States) were much reduced.

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[30] Economic Review of the Soviet Union, The Soviet Nonferrous Metal Industry: Vol. 6, No. 1, Jan. 1, 1931, p. 11.

[31] Russian Economic Notes, No. 112, 1931, p. 5.

Mercury produced in Spain, 1928 and 1929

Province	Ore mined						Metal produced				
	Number of mines	Number of workmen	Metric tons	Tenor (per cent)	Value [1]	Tons per man	Number of plants	Number of workmen	Flasks (76 pounds)	Value [1]	Flasks per man
1928											
Ciudad Real	1	756	46,832	5.73	$1,328,909	61.95	1	336	63,397	$3,971,250	188.68
Granada	3	30	1,675	.95	10,567	55.83	1	21	278	25,385	13.24
	4	786	48,507	5.56	1,339,476	61.71	2	357	63,675	3,996,635	178.36
1929											
Ciudad Real	1	480	34,666	5.74	870,409	72.22	1	410	71,562	5,252,392	174.54
Granada	3	30	1,612	.95	8,998	53.73	1	21	270	24,619	12.86
	4	510	36,278	5.53	879,407	71.13	2	431	71,832	5,277,011	166.66

[1] Pesetas converted to dollars at the average annual rate of exchange, as published by the U. S. Federal Reserve Board.

Production at the Almadén mines for the past 25 years has been as follows according to Spanish official statistics:[32]

Mercury produced at the Almadén mines, 1905–1929

Year	Ore (kilograms)	Mercury		Average yield (per cent)
		Kilograms	Flasks [a]	
1905	14,811,320	791,568	22,938	5.34
1906	16,152,170	1,500,847	43,493	9.29
1907	13,742,332	1,160,884	33,641	8.45
1908	18,956,771	1,017,002	29,432	5.36
1909	17,523,322	1,344,010	38,948	7.67
1910	15,489,893	1,102,828	31,959	7.12
1911	12,644,023	1,478,825	42,855	11.70
1912	13,668,027	1,186,901	34,395	8.68
1913	12,391,175	1,238,576	35,893	10.00
1914	11,155,871	956,801	27,727	8.58
1915	10,613,495	1,200,102	34,778	11.31
1916	10,127,686	771,181	22,348	7.61
1917	9,808,162	827,115	23,969	8.43
1918	[b] 18,597,264	[b] 249,408	[b] 7,227	1.34
1919	18,597,264	1,196,723	34,680	6.43
1920	13,832,065	849,841	24,628	6.14
1921	12,457,897	619,004	17,938	4.97
1922	13,512,598	1,314,160	38,083	9.73
1923	14,764,651	1,136,071	32,922	7.69
1924	13,606,557	893,663	25,898	6.57
1925	[c] 22,593,000	[c] 1,277,337	[c] 37,017	5.65
1926	[c] 30,008,000	[c] 1,594,168	[c] 46,198	5.31
1927	50,120,000	[c] 2,492,999	[c] 72,246	4.97
1928	[c] 48,507,000	[c] 2,195,121	[c] 63,614	4.53
1929	[c] 36,278,000	[c] 2,476,294	[c] 71,762	6.83

[a] 1 flask equivalent to 34.507 kilograms.

[b] Figures given as reported; evidently there has been some typographical error which can not be determined from the records available in the Bureau of Mines.

[c] Including production of the mine in Granada Province which customarily represents only about 0.444 per cent of the total ore and 0.376 per cent of the total pure mercury.

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[32] Stafford, M. L., American consul, Madrid, The Mercury Mines at Almadén, Spain: Consular Rept. 13025 (Bureau of Mines Foreign Files 10866), Dec. 29, 1930.

Mercury exported from Spain, 1925–1930, by countries of destination, in flasks[1]

[1 flask = 34.507 kilograms or 76.1 pounds]

Destination	1925	1926	1927	1928	1929	1930[2]
Great Britain	10,876	20,454	11,737	14,261	7,167	8,094
United States	10,117	13,093	12,151	5,060	10,621	3,255
Belgium	6,097	4,332	5,880	16,191	2,617	617
Germany	5,179	3,944	5,460	4,529	976	742
Italy	3,860	3,872	(3)	(3)	1,197	(3)
France	(3)	(3)	7,123	4,755	(3)	(3)
Other	1,898	2,930	2,892	2,820	3,272	1,704
	38,027	48,625	45,243	47,616	25,250	14,412

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[1] Compiled from data furnished by American Consul M. L. Stafford, Madrid, Spain, Dec. 29, 1930.
[2] First 10 months.
[3] Not reported separately.

IRON ORE, PIG IRON, AND STEEL[1]

By HUBERT W. DAVIS[2]

CONTENTS

- General review — 57
- Iron ore — 58
  - Quantities mined and shipped in 1930 — 58
  - Principal iron-ore mines — 63
  - Stocks of ore at mines — 66
  - Value of ore per ton — 66
  - Iron ore consumed — 67
  - Lake Superior district — 70
    - Production — 70
    - Shipments and receipts — 70
    - Stocks of ore at Lake Erie ports — 71
    - Prices of Lake Superior ore — 71
    - Iron-ore reserves — 71
  - Iron-ore mining, by States — 72
    - Lake Superior district — 72
      - Michigan — 72
      - Minnesota — 73
      - Wisconsin — 74
      - Iron-ore analyses — 75
    - Southeastern States — 75
      - Alabama — 75
      - Georgia — 76
      - Tennessee — 77
      - Virginia — 77
    - Missouri — 77
    - Northeastern States — 77
      - New Jersey — 77
      - New York — 78
      - Pennsylvania — 78
    - Western States — 79
      - Arizona — 79
      - Colorado — 79

Iron ore—Continued.

Iron-ore mining, by States—Continued.

Western States—Continued.

- New Mexico — 79
- Utah — 79
- Wyoming — 79
- Foreign trade in iron ore — 79
  - Imports and exports — 79
  - Iron-ore mining in Cuba — 81
- World production of iron ore, by countries — 81
- Beneficiated iron ore — 83
- Iron and steel — 84
  - Pig iron — 85
    - Shipments, value, and production, by States — 85
    - Average values — 86
    - Production by grades and by fuel used, total production, and blast furnaces — 88
    - Foreign trade in pig iron — 89
    - World production of pig iron, by countries — 90
  - Ferro-alloys — 91
    - Production, shipments, value, and prices — 91
      - Ferromanganese — 92
      - Spiegeleisen — 93
      - Ferrosilicon — 94
      - Ferrotungsten — 94
      - Ferrovanadium — 94
    - Imports and exports — 94
  - Steel — 96
    - Production — 96
    - Foreign trade in steel — 97

GENERAL REVIEW

In 1930 the production and shipments of iron ore decreased 20 and 27 per cent, respectively, as compared with 1929. The production in 1930 was 89 per cent of the average for the preceding 5 years and 98 per cent of the average for the preceding 10 years. The output of pig iron, including ferro-alloys, decreased 25 per cent as compared with 1929. It was 82 per cent of the average for the preceding 5 years and 92 per cent of the average for the preceding 10 years.

The average value per ton of iron ore at the mines in 1930 was 3 cents more than in 1929. The average values at the furnaces of pig iron, ferromanganese, and spiegeleisen declined 48 cents, $4.79, and $1.08 a ton, respectively, in 1930. Earnings of 20 of the leading steel manufacturers in the United States, according to Steel,[3] showed a return on capitalization of 4.54 per cent in 1930, as compared with 9.26 per cent in 1929.

According to Iron Age,[4] for the first time since 1927 building and construction took the lead as the largest consumer of steel in 1930, accounting for 19 per cent of the total, as compared with 16.5 per cent in 1929. The automotive industry, the leader in steel consumption in both 1928 and 1929, accounted for only 15.5 per cent in 1930, as compared with 18 per cent in 1929, and descended to second place among consuming industries. Railroads, second in consumption of steel in 1929, accounted for 15 per cent of the total in 1930, as compared with 17 per cent in 1929, and dropped to third place. Among the smaller outlets for steel production the oil, gas, water, mining, and lumbering industries accounted for 11.5 per cent of the total, containers for 6 per cent, exports for 5.5 per cent, agriculture for 4 per cent, and machinery for 3 per cent.

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[1] Work on manuscript completed June, 1931.

[2] Statistics on iron ore compiled by K. V. Herlihy, of the Bureau of Mines; data on imports and exports compiled from the records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, also of the Bureau of Mines.

[3] Steel: Vol. 88, May 7, 1931, p. 29. *See also* Steel: Vol. 88, Apr. 23, 1931, p. 36.

[4] Iron Age, Building Construction Resumes Lead in Steel Consumption: Vol. 127, Jan. 1, 1931, pp. 7–9.

The total domestic output of pig iron required about 60 per cent of the annual capacity, according to figures of the American Iron and Steel Institute, but this capacity was not utilized steadily. At the beginning of 1930 there were 165 furnaces in blast, on June 30 there were 164, and at the end of the year there were 97. The production of steel ingots is considered to have been about 59 per cent of the rated capacity, having ranged from about 36 per cent in December to about 76 per cent in March. The output of pig iron in the United States in 1930 represented about 40 per cent of the world production and was about 26 per cent less than that of the producing countries of Europe combined. The production of pig iron decreased 12 per cent in Europe in 1930, as compared with a decrease of 25 per cent in the United States.

In common with practically all other branches of mineral production the iron-ore mining industry was affected adversely by the general business depression in 1930. In the Lake Superior district mining was less active than in any year since 1924, and the production was 11 per cent below the average for the previous five years. As the production of iron ore in the Lake Superior district in 1930 was about 2,900,000 tons in excess of shipments the contribution of the operators in aiding unemployment by continuing operations despite market conditions is obvious. Eastern furnaces took only 150,000 tons of Lake ore in 1930, as compared with 1,200,000 tons in 1929. A computation of iron-mining costs in Michigan in 1930 by the State mine appraiser showed that the operators' gross profit (exclusive of royalty and interest on borrowed money) at underground mines was 94 cents a ton, as compared with 99 cents a ton in 1929, and that the gross profit at siliceous open-pit mines in 1930 was 18 cents a ton, as compared with 16 cents a ton in 1929. The average daily wage at iron-ore mines in Michigan in 1930 was $4.997 and the average yearly earning was $1,436.55 as compared with $4.915 and $1,395.77, respectively, in 1929.

IRON ORE

QUANTITIES MINED AND SHIPPED IN 1930

In the following tables the quantities of iron ore shown include ore that was beneficiated—that is, treated in any way—as well as crude ore not requiring treatment. The figures on both production and shipments include the iron ore used for fluxing other metallic ores at smelters in the Western States; the shipments, however, do not include the iron ore sold for the manufacture of paint, which amounted to 9,671 gross tons in 1930, valued at $53,520, or $5.53 a ton, compared with 14,066 tons in 1929, valued at $90,352, or $6.42 a ton. The output of manganiferous iron ore that contained 5 per cent or more of manganese amounted to 785,390 gross tons, valued at $2,401,605, as compared with 1,188,258 tons, valued at $3,274,466, in 1929. In Arkansas one producer shipped 5 gross tons of loadstone, which is not included in the tabulated statistics of iron ore. Neither do the statistics include the iron sinter recovered from copper sulphide ore mined in Tennessee.

Iron ore was mined in 17 States in both 1929 and 1930. Arizona and Virginia again entered the list of iron-ore producing States, and California and Washington dropped out. The greater part of the iron ore mined in the United States is sold for use in the manufacture of pig iron and steel, but small quantities of ore from Arizona and New Jersey were sold for use in purifying gas and some ore produced in Michigan, New York, Pennsylvania, Tennessee, Utah, and Wisconsin was sold for use in making paint. The rank of the three States producing the largest quantity of iron ore—Minnesota, Michigan, and Alabama—remained unchanged. Minnesota is producing more iron ore than all the rest of the States together and has furnished a little more than 60 per cent of the total for the United States in the last five years.

The ores of iron are classed under four heads—hematite, brown ore, magnetite, and carbonate. Notes on the composition of these ores are given in Mineral Resources, 1916, Part I, pages 537–541.

Hematite has always been the predominant ore of iron and has constituted about 90 per cent of the total iron ore mined in the United States. In 1930, 94.63 per cent of the domestic iron ore mined was hematite; large quantities were obtained in Alabama, Michigan, Minnesota, Utah, Wisconsin, and Wyoming and smaller quantities in Arizona, Missouri, New York, and Tennessee. Although not exploited at present, deposits of hematite are also found in California, Colorado, Georgia, Kentucky, Maryland, New Mexico, South Dakota, Virginia, and Washington.

Magnetite is far below hematite in proportion of production, having contributed only about 5 per cent (in 1930, only 4.14 per cent) of the total iron ore mined in the United States. During 1930 it was mined in New Jersey, New Mexico, New York, North Carolina, and Pennsylvania, but deposits not being worked at present occur in Arizona, California, Colorado, Minnesota, Nevada, South Carolina, Texas, Utah, Washington, and Wyoming.

Brown ore also ranks far below hematite and is slightly below magnetite in proportion of production and has contributed only about 5 per cent (in 1930, only 1.23 per cent) of the total iron ore mined in the United States. Most of the brown ore produced in 1930 was mined in the Birmingham and Russellville districts, Alabama; the remainder was mined in Colorado, Georgia, Missouri, Tennessee, Utah, and Virginia. Deposits of brown ore are also found in about 17 other States.

The production of iron carbonate is insignificant compared with that of the other ores, as it has constituted less than half of 1 per cent (in 1930, only 0.0017 per cent) of the total iron ore mined in the United States. Iron carbonate is common in Ohio, Pennsylvania, and West Virginia; some occurs also in Alabama, Colorado, Kentucky, Mississippi, and Texas. In recent years, however, carbonate has been mined only in Pennsylvania.

Iron ore mined in the United States, 1929 and 1930, by States and varieties, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

State	Number of active mines	Hematite	Brown ore	Magnetite	Carbonate	Total
1929						
Alabama	28	5,826,912	626,163			6,453,075
California	1		303			303
Colorado	1		50,754			50,754
Georgia	6		59,316			59,316
Michigan	58	15,456,397				15,456,397
Minnesota	85	45,700,858				45,700,858
Missouri	4	167,301	1,633			168,934
New Jersey	4			281,327		281,327
New Mexico	1			171,585		171,585
New York	5	(1)		[1] 822,261		822,261
North Carolina	2			30,675		30,675
Pennsylvania	2			1,090,238	1,775	1,092,013
Tennessee	5	68,755	33,416			102,171
Utah	[2] 3	[3] 320,960	[2] [3] 4,025			[2] 324,985
Washington	1			5,018		5,018
Wisconsin	4	1,608,571				1,608,571
Wyoming	1	639,477				639,477
	211	[1] [3] 69,849,231	[3] 775,610	[1] 2,401,104	1,775	73,027,720
1930						
Alabama	23	5,151,089	587,389			5,738,478
Arizona	1	923				923
Colorado	1		32,247			32,247
Georgia	5		52,221			52,221
Michigan	60	13,544,277				13,544,277
Minnesota	84	34,517,748				34,517,748
Missouri	6	132,434	315			132,749
New Jersey	6			394,639		394,639
New Mexico	2			173,432		173,432
New York	5	(1)		[1] 889,405		889,405
North Carolina	1			100		100
Pennsylvania	2			963,635	1,003	964,638
Tennessee	3	326	27,384			27,710
Utah	3	[3] 277,774	[3] 1,344			279,118
Virginia	1		19,596			19,596
Wisconsin	4	1,321,360				1,321,360
Wyoming	1	320,023				320,023
	208	[1] [3] 55,265,954	[3] 720,496	[1] 2,421,211	1,003	58,408,664

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[1] Some hematite included with magnetite. [2] Revised figures. [3] Some hematite included with brown ore.

Iron ore mined in the United States, 1929 and 1930, by States and counties

State and county	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Alabama:				
Blount	5	228,064	4	177,554
Calhoun	3	2,581		
Etowah	1	12,769		
Franklin	2	143,374	2	165,090
Jefferson	6	5,814,143	5	5,151,089
Shelby			1	50,000
Tuscaloosa	4	239,358	3	173,041
Butler	1	7,230	5	16,239
Talladega	2			
Coosa			1	5,465
Cherokee	4	5,556	2	
	28	6,453,075	23	5,738,478
Arizona: Yuma			1	923
California: Alameda	1	303		
Colorado: Saguache	1	50,754	1	32,247
Georgia:				
Bartow	1	8,725	1	13,934
Polk	5	50,591	4	38,287
	6	59,316	5	52,221

Iron ore mined in the United States, 1929 and 1930, by States and counties—Con.

State and county	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Michigan:				
Baraga	1	91,374	1	89,342
Dickinson	5	1,289,150	5	1,155,994
Gogebic	17	5,553,199	17	4,760,565
Iron	20	4,068,209	21	3,207,902
Marquette	15	4,454,465	16	4,330,474
	58	15,456,397	60	13,544,277
Minnesota:				
Crow Wing	9	1,506,119	9	1,221,332
Itasca	23	8,743,189	27	7,510,593
St. Louis	53	35,511,550	48	25,785,823
	85	45,760,858	84	34,517,748
Missouri:				
St. Francois	1	137,181	1	97,012
Franklin	1	31,753	1	21,000
Stoddard	1			
Crawford	1		1	14,737
Dent			1	
Texas			1	
Washington			1	
	4	168,934	6	132,749
New Jersey:				
Morris	3	281,327	4	323,428
Passaic	1		1	
Warren			1	71,211
	4	281,327	6	394,639
New Mexico: Grant	1	171,585	2	173,432
New York:				
Clinton	1	160,946	1	193,232
Essex	1	580,748	1	634,871
Oneida	1	80,567	1	61,302
Orange	1		1	
Wayne	1		1	
	5	822,261	5	889,405
North Carolina:				
Ashe	1	100	1	100
Avery	1	30,575		
	2	30,675	1	100
Pennsylvania:				
Carbon	1	1,775	1	1,003
Lebanon	1	1,090,238	1	963,635
	2	1,092,013	2	964,638
Tennessee:				
Dickson	2	8,880		
Hickman	1	24,536	1	23,277
Lawrence			1	4,107
Hamilton	1	68,755	1	326
Roane	1			
	5	102,171	3	27,710
Utah:				
Box Elder	[1] 1	[1] 100	1	200
Iron	1	320,960	1	277,774
Utah	1	3,925	1	1,144
	[1] 3	[1] 324,985	3	279,118
Virginia: Wythe			1	19,596
Washington: Stevens	1	5,018		
Wisconsin:				
Dodge	1	1,058	1	733
Florence	1	71,110	1	67,181
Iron	2	1,536,403	2	1,253,446
	4	1,608,571	4	1,321,360
Wyoming: Platte	1	639,477	1	320,023
Total for United States	211	73,027,720	208	58,408,664

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[1] Revised figures.

Iron ore mined in the United States, by mining districts and varieties, 1929 and 1930, in gross tons

[Exclusive of ore containing 5 per cent or more of manganese]

District	Hematite	Brown ore	Magnetite	Carbonate	Total
1929					
Lake Superior [1]	62,824,768				62,824,768
Birmingham	5,814,143	467,422			6,281,565
Chattanooga	81,524	74,429			155,953
Adirondack			[2] 749,976		[2] 749,976
Northern New Jersey and southeastern New York			353,612		353,612
Other districts	[2] [3] 1,128,796	[3] 233,759	1,297,516	1,775	[2] 2,661,846
	[2] [3] 69,849,231	[3] 775,610	[2] 2,401,104	1,775	73,027,720
1930					
Lake Superior [1]	49,382,652				49,382,652
Birmingham	5,151,089	400,595			5,551,684
Chattanooga	326	73,925			74,251
Adirondack			[2] 833,225		[2] 833,225
Northern New Jersey and southeastern New York			450,819		450,819
Other districts	[2] [3] 731,887	[3] 245,976	1,137,167	1,003	[2] 2,116,033
	[2] [3] 55,265,954	[3] 720,496	[2] 2,421,211	1,003	58,408,664

[1] Includes only those mines in Wisconsin that are in the true Lake Superior district.

[2] Some hematite from "Other districts" included with magnetite from Adirondack district.

[3] Some hematite included with brown ore.

The Lake Superior district, which comprises Minnesota, Michigan, and northern Wisconsin, mined 84.5 per cent of the total iron ore produced in 1930, and the Birmingham district mined 9.5 per cent. The Adirondack and northern New Jersey and southeastern New York districts each produced more ore in 1930 than in 1929.

The following table shows the production of iron ore in the United States so far as it has been recorded or estimated. The figures for the years prior to 1860 are not strictly accurate, as they were calculated from the pig iron produced and included both imported and domestic ore.

Iron ore mined in the United States, 1810–1930, in gross tons

[Exclusive after 1905 of ore containing 5 per cent or more of manganese]

Year	Hematite	Brown ore	Magnetite	Carbonate	Total
1810–1869					49,656,000
1870 [1]–1880					51,690,889
1881–1890					103,854,386
1891–1900	136,961,046	22,845,764	14,634,364	1,065,157	175,506,311
1901–1910	364,179,432	[2] 28,287,994	[2] 20,664,453	262,366	413,394,245
1911–1920	[3] [4] 568,388,602	[4] 16,318,820	[3] 21,902,614	48,035	606,658,071
1921	[3] [4] 28,337,249	[4] 570,154	[3] 580,866	2,709	29,490,978
1922	[4] 44,888,723	[4] 783,582	1,452,966	3,256	47,128,527
1923	[4] 65,924,454	[4] 1,232,848	2,190,624	3,516	69,351,442
1924	[4] 52,102,300	[4] 814,159	1,347,711	3,249	54,267,419
1925	[4] 59,546,690	[4] 884,600	1,472,004	4,703	61,907,997
1926	[4] [5] 64,634,573	[4] 810,924	[5] 2,175,288	2,215	67,623,000
1927	[4] [5] 58,505,543	[4] 743,478	[5] 2,489,586	2,493	61,741,100
1928	[5] 59,207,857	816,637	[5] 2,170,804	1,790	62,197,088
1929	[4] [5] 69,849,231	[4] 775,610	[5] 2,401,104	1,775	73,027,720
1930	[4] [5] 55,265,954	[4] 720,496	[5] 2,421,211	1,003	58,408,664
					1,985,903,837

[1] Includes ore produced by owners of blast furnaces, estimated by census at 800,000 tons.

[2] Some brown ore included with magnetite.

[3] Some magnetite included with hematite.

[4] Some hematite included with brown ore.

[5] Some hematite included with magnetite.

No iron ore was reported as sold for use in fluxing other metallic ores at smelters in the Western States in 1929 and 1930. The ore sold for purifying gas amounted to 536 gross tons, as compared with 1,016 tons in 1929. The domestic iron ore sold for the manufacture of pig iron and steel in 1930 amounted to 55,200,685 gross tons, valued at $145,615,848, as compared with 75,596,700 tons, valued at $197,118,452, in 1929.

Iron ore shipped from mines in the United States, 1929 and 1930, by States

[Exclusive of ore containing 5 per cent or more of manganese and ore sold for paint]

State	1929		1930	
	Gross tons	Value	Gross tons	Value
Alabama	6,637,299	$12,575,113	5,637,678	$11,015,336
Arizona			923	(1)
Colorado	50,754	(1)	32,247	(1)
Georgia	59,316	175,145	52,221	147,964
Michigan	16,838,568	47,597,976	11,154,773	31,515,996
Minnesota	46,470,243	121,776,312	34,165,777	90,835,451
Missouri	171,456	661,055	132,749	508,354
New Jersey	285,115	1,157,848	391,528	1,632,827
New Mexico	171,585	(1)	173,432	(1)
New York	875,564	3,941,985	755,074	3,663,155
North Carolina	30,575	106,411		
Pennsylvania	1,151,130	2,382,839	894,039	1,850,661
Tennessee	101,796	234,827	27,384	76,089
Utah	324,885	(1)	278,918	(1)
Virginia	232	631	36,178	65,528
Washington	5,018	(1)		
Wisconsin	1,789,721	4,848,978	1,148,277	3,179,175
Wyoming	639,477	(1)	320,023	(1)
Undistributed		[2] 1,689,520		[2] 1,128,523
	75,602,734	197,148,640	55,201,221	145,619,059

[1] Included under "Undistributed."

[2] This figure includes value for States entered as "(1)" above.

Iron ore shipped from mines in the United States, 1921–1930

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

Year	Gross tons	Value	Year	Gross tons	Value
1921	26,652,528	$89,745,308	1926	69,292,832	$174,015,645
1922	50,612,620	157,809,286	1927	61,232,473	151,125,820
1923	69,811,472	240,738,921	1928	63,432,826	155,788,657
1924	52,083,375	151,307,105	1929	75,602,734	197,148,640
1925	63,924,763	160,796,886	1930	55,201,221	145,619,059

PRINCIPAL IRON-ORE MINES

In 1930, 208 iron-ore mines were active, compared with 211 in both 1929 and 1928; 130 mines produced more than 100,000 gross tons each, compared with 130 also in 1929 and 124 in 1928. Of these 130 mines 12 (10 in Minnesota, 1 in Alabama, and 1 in Wisconsin) produced more than 1,000,000 tons each, compared with 14 (9 in Minnesota, 2 in Alabama, 1 in Wisconsin, 1 in Pennsylvania, and 1 in Michigan) in 1929, and 10 (7 in Minnesota, 2 in Alabama, and 1 in Michigan) in 1928. The operators of all but one of these large mines have permitted the publication of output; the figures are given in the following table. The predominance of hematite as an iron ore is clearly shown by the fact that of these 130 large mines 122 produced hematite and only 6 produced magnetite and 2 brown ore. The trend toward large mining units is shown in the production of more than 96 per cent of the output of the country by the 130 mines which yielded more than 100,000 tons each. The mines that produced more than 1,000,000 tons each in 1930 furnished 36 per cent of the total. The average production per mine in 1930 was 280,811 gross tons, as compared with 346,103 tons in 1929.

Iron-ore mines of the United States that produced more than 100,000 gross tons each in 1930

Rank	Name of mine	State	Nearest town	Variety of ore	Gross tons
1	Missabe Mountain	Minnesota	Virginia	Hematite	2,943,016
2	Red Mountain group	Alabama	Bessemer	do	2,796,416
3	Hull-Rust	Minnesota	Hibbing	do	2,642,171
4	Sellers	do	do	do	2,291,131
5	Mahoning	do	do	do	1,817,707
6	Minnewas	do	Virginia	do	1,578,519
7	Adams-Spruce group	do	Eveleth	do	1,534,586
8	Leonidas	do	do	do	1,211,168
9	Hartley-Burt	do	Chisholm	do	1,108,751
10	Pioneer	do	Ely	do	1,090,719
11	Montreal	Wisconsin	Montreal	do	1,043,097
12	Hill Annex	Minnesota	Calumet	do	1,000,089
13	Cornwall	Pennsylvania	Miners Village.	Magnetite	963,635
14	Norrie-Aurora	Michigan	Ironwood	Hematite	950,349
15	Woodward Nos. 1 and 3	Alabama	Bessemer	do	940,539
16	Morris	Minnesota	Hibbing	do	918,284
17	Morrison	do	Coleraine	do	723,822
18	Dunwoody	do	Chisholm	do	698,383
19	Witherbee, Sherman & Co. group	New York	Mineville	Magnetite	634,871
20	Raimund Nos. 1 and 2	Alabama	Bessemer	Hematite	614,591
21	Sloss Nos. 1 and 2	do	do	do	611,469
22	Negaunee	Michigan	Negaunee	do	579,740
23	Godfrey	Minnesota	Chisholm	do	572,238
24	Holman-Brown	do	Taconite	do	553,699
25	Newport	Michigan	Ironwood	do	544,735
26	Ironton	do	Bessemer	do	517,200
27	Mesabi Chief	Minnesota	Nashwauk	do	470,928
28	Bennett	do	Keewatin	do	467,657
29	Morris-Lloyd	Michigan	Ishpeming	do	465,371
30	Scranton	Minnesota	Hibbing	do	465,207
31	Asteroid-Eureka	Michigan	Ramsay	do	461,085
32	Sunday Lake	do	Wakefield	do	460,072
33	North Harrison	Minnesota	Cooley	do	447,438
34	Arcturus	do	Marble	do	446,411
35	Shenango	do	Chisholm	do	439,241
36	Fayal	do	Eveleth	do	421,427
37	Maas	Michigan	Negaunee	do	416,653
38	Chapin	do	Iron Mountain	do	413,547
39	La Rue	Minnesota	Nashwauk	do	413,255
40	Cliffs Shaft	Michigan	Ishpeming	do	407,925
41	Plymouth	do	Wakefield	do	404,292
42	Sibley	Minnesota	Ely	do	404,096
43	Susquehanna	do	Hibbing	do	403,835
44	Hill-Trumbull	do	Marble	do	402,598
45	Wakefield	Michigan	Wakefield	do	401,233
46	Wacootah	Minnesota	Mountain Iron	do	394,228
47	Athens	Michigan	Negaunee	do	385,461
48	Penn group	do	Vulcan	do	385,435
49	St. Paul	Minnesota	Keewatin	do	378,585
50	Webb	do	Hibbing	do	358,571
51	Armour No. 1	do	Crosby	do	344,669
52	Patrick (including Ann)	do	Cooley	do	339,579
53	Wellington	do	Chisholm	do	337,973
54	Puritan	Michigan	Ironwood	do	333,731
55	Sunrise	Wyoming	Sunrise	do	320,023
56	Zenith	Minnesota	Ely	do	317,136
57	Hawkins	do	Nashwauk	do	312,869
58	Alexandria	do	Hibbing	do	310,022
59	Bristol-Youngstown	Michigan	Crystal Falls	do	306,283
60	South Agnew	Minnesota	Hibbing	do	289,305
61	Danube	do	Bovey	do	289,192
62	Tilden	Michigan	Ishpeming	do	287,043
63	Desert Mound	Utah	Iron Springs	do	277,774
64	Biwabik	Minnesota	Biwabik	do	276,921
65	Volunteer	Michigan	Palmer	do	270,957
66	Archibald	do	Gwinn	do	259,302
67	Lake Superior-Holmes	do	Ishpeming	do	247,450

Iron-ore mines of the United States that produced more than 100,000 gross tons each in 1930—Continued

Rank	Name of mine	State	Nearest town	Variety of ore	Gross tons
68	Harold	Minnesota	Stuntz	Hematite	246, 966
69	Armour No. 2 (including Cuyuna-Duluth).	do	Crosby	do	237, 696
70	Albany	do	Hibbing	do	235, 741
71	James	Michigan	Iron River	do	231, 317
72	Utica	Minnesota	Hibbing	do	220, 577
73	Bruce	do	Chisholm	do	217, 305
74	Caspian	Michigan	Iron River	do	216, 687
75	Cary	Wisconsin	Hurley	do	210, 349
76	Holmes	Michigan	Ishpeming	do	201, 153
77	Burt-Pool-Day	Minnesota	Hibbing	do	200, 667
78	Riverton group	Michigan	Iron River	do	199, 186
79	Chateaugay	New York	Lyon Mountain.	Magnetite	193, 232
80	West Davis	Michigan	Ironwood	Hematite	189, 652
81	Lincoln	Minnesota	Virginia	do	189, 338
82	Blueberry	Michigan	Ishpeming	do	189, 103
83	Shannon	Alabama	Birmingham	do	188, 074
84	Berkshire	Michigan	Stambaugh	do	187, 461
85	Warner	do	Amasa	do	186, 132
86	Isabella	do	Palmer	do	186, 020
87	Rogers	do	Iron River	do	184, 834
88	Corsica	Minnesota	Gilbert	do	181, 127
89	Balkan-Judson	Michigan	Alpha	do	179, 872
90	Aragon	do	Norway	do	176, 839
91	Croft	Minnesota	Crosby	do	174, 538
92	Sargent	do	Keewatin	do	174, 455
93	Genesee (including Tobin)	Michigan	Crystal Falls	do	172, 200
94	Union Hill (including Republic)	New Mexico	Fierro	Magnetite	170, 911
95	Buck	Michigan	Iron River	Hematite	167, 242
96	Cambria (including Lillie)	do	Negaunee	do	164, 726
97	Russellville	Alabama	Russellville	Brown ore	163, 695
98	Wade	Minnesota	Kinney	Hematite	160, 854
99	Hiawatha	Michigan	Iron River	do	160, 840
100	Union	Minnesota	Virginia	do	159, 917
101	Soudan	do	Soudan	do	154, 287
102	Loretto	Michigan	Loretto	do	154, 143
103	Orwell	Minnesota	Bovey	do	151, 501
104	Genoa	do	Gilbert	do	150, 850
105	Forbes	Michigan	Iron River	do	149, 426
106	Mahoning-Rust	Minnesota	Hibbing	do	147, 342
107	Davidson No. 1	Michigan	Iron River	do	146, 992
108	Evergreen	Minnesota	Crosby	do	146, 939
109	Agnew	do	Hibbing	do	143, 317
110	Virgil	Michigan	Iron River	do	142, 827
111	Halobe	Minnesota	Cooley	do	136, 182
112	Bates	Michigan	Iron River	do	135, 324
113	Zimmerman	do	Gaastra	do	132, 780
114	Homer	do	Iron River	do	129, 040
115	Richmond	do	Palmer	do	126, 542
116	Margaret	Minnesota	Buhl	do	125, 867
117	Gardner-Mackinaw	Michigan	Gwinn	do	125, 157
118	Hoadley	Minnesota	Naskwauk	do	120, 725
119	Bingham (including North Star)	do	Taconite	do	119, 349
120	Mt. Hope	New Jersey	Wharton	Magnetite	118, 140
121	Mace No. 2	Minnesota	Nashwauk	Hematite	117, 948
122	[1]	[1]	[1]	[1]	116, 636
123	Harrison	Minnesota	Cooley	Hematite	116, 621
124	Townsite	Michigan	Ironwood	do	111, 710
125	Champion No. 1	Alabama	Champion	Brown ore	110, 000
126	Keweenaw	Michigan	Bessemer	Hematite	104, 671
127	Kevin	Minnesota	Cooley	do	104, 319
128	Kinney	do	Kinney	do	103, 873
129	Palms	Michigan	Bessemer	do	101, 646
130	Maroco	Minnesota	Ironton	do	101, 399
	Total (130 mines)				56, 279, 964
	Output of 20 mines producing between 50,000 and 100,000 tons each				1, 484, 850
	Output of 58 mines producing less than 50,000 tons each				643, 850
	Grand total of United States (208 mines)				58, 408, 664

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[1] Bureau of Mines not at liberty to publish identification.

STOCKS OF ORE AT MINES

According to the reports of producers the total quantity of iron ore in stock at the mines at the end of 1930 amounted to 10,383,152 gross tons, compared with 7,067,206 tons at the end of 1929, an increase of 47 per cent. As the quantity of ore in stock piles is of necessity partly estimated, resulting variations in the mine reports from year to year prevent an absolute balance between the quantity mined and the quantity shipped and the stocks on hand. The reported stocks at the end of 1930 were about 1,038,000 tons above the average for the 5-year period 1925 to 1929.

Stocks of iron ore at mines December 31, 1929 and 1930, by States, in gross tons

State	1929	1930	State	1929	1930
Alabama	807,331	909,498	North Carolina	100	200
Iowa	12,165	12,165	Pennsylvania	32,719	103,183
Michigan	4,267,279	6,654,663	Virginia	20,055	3,473
Minnesota	1,713,426	2,171,194	Wisconsin	127,794	303,183
New Jersey	62,173	65,163			
New York	24,164	160,430		7,067,206	10,383,152

VALUE OF ORE PER TON

The table that follows gives the average value at the mines of the different classes of iron ore in 1929 and 1930 for each of the producing States or groups of States except where the shippers of a certain variety of ore in a State were less than three and permission was not given to publish the value. These figures are taken directly from statements of the producers and probably represent the commercial selling prices only approximately, as not all of the reports are consistent. Some of them evidently include mining costs only; others contain, in addition, the cost of selling and insuring the ore; others include an allowance for a sinking fund; and still others include only the costs charged against the blast furnaces. None of the reports, however, is supposed to include freight charges.

Average value per gross ton of iron ore at mines in the United States, 1929 and 1930

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

State	Hematite		Brown ore		Magnetite	
	1929	1930	1929	1930	1929	1930
Alabama	$1.83	$1.88	$2.49	$2.79		
Georgia			2.95	2.83		
Michigan	2.83	2.83				
Minnesota	2.62	2.66			(1)	
Missouri	3.89	3.83	(1)	(1)		
New Jersey			(1)	(1)	$4.05	$4.17
New York					4.60	4.85
North Carolina					3.48	
Pennsylvania					2.07	2.07
Tennessee	2.18		2.56	2.78		
Virginia			2.72	1.81		
Wisconsin	2.71	2.77				
Other States[2]	1.31	1.23	1.54	1.41	1.98	1.97
	2.59	2.61	2.47	2.53	3.15	3.38

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[1] Less than three producers, permission to publish not given, therefore value may not be shown.

[2] 1929. Colorado, New Mexico, Utah, Washington, and Wyoming. 1930. Arizona, Colorado, New Mexico, Utah, and Wyoming.

The following table summarizes the average value of iron ore at the mines from 1916 to 1930. Not until 1917 did the average value rise above $3 a ton; the average for 1920, $4.11, is the highest on record.

Average value per gross ton of iron ore at mines in the United States, 1916–1930

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

Year	Hematite	Brown ore	Magnetite	Carbonate	General average [1]
1916	$2.32	$2.03	$3.11	$3.00	$2.34
1917	3.12	2.95	4.29	------------	3.15
1918	3.35	3.51	4.60	------------	3.39
1919	3.48	3.63	4.08	------------	3.50
1920	4.09	4.19	4.59	(2)	4.11
1921	3.37	2.63	3.61	(2)	3.37
1922	3.14	2.65	2.37	(2)	3.12
1923	3.46	2.88	3.34	(2)	3.45
1924	2.91	2.75	2.95	(3)	2.91
1925	2.50	2.78	3.07	(3)	2.52
1926	2.49	2.83	3.13	(2)	2.51
1927	2.43	2.62	3.38	(2)	2.47
1928	2.43	2.47	3.04	(2)	2.46
1929	2.59	2.47	3.15	(2)	2.61
1930	2.61	2.53	3.38	(2)	2.64

[1] Average values in 1889 and 1892–1915 are given in Mineral Resources for 1919 and many earlier volumes.

[2] Sold for paint and not included in shipments of iron ore.

[3] Carbonate of iron, used in making pig iron, was sold by one producer in Ohio in 1924 and 1925; that from Pennsylvania was sold for paint.

IRON ORE CONSUMED

The furnaces in Alabama in making 1 ton of pig iron consumed in 1930 an average of 2.435 tons of ore, the highest average for any State. The greater part of the iron ore used in Alabama furnaces in 1930 was hematite from mines in Jefferson County, Ala.; small quantities of imported ore and of iron sinter from Tennessee were also used. The brown ore used was obtained chiefly from mines in the Birmingham and Russellville districts, Alabama, and the Cedartown district, Georgia, and the manganiferous iron ore was chiefly from mines in Alabama, Arkansas, and Georgia.

In 1930 the furnaces in Maryland used chiefly foreign ores obtained from Algeria, Australia, Chile, Cuba, Morocco, Russia, Spain, and Sweden, although some ore from the Lake Superior district was also used. The Maryland furnaces consumed an average of only 1.4 tons of ore in making 1 ton of pig iron in 1930; however, they used proportionately more cinder, scale, and scrap than the furnaces in any other State except Kentucky.

The blast furnaces in Indiana, Kentucky, Michigan, Minnesota, and West Virginia used Lake Superior iron ore and manganiferous iron ore exclusively in 1930. The consumption of ores per ton of iron made ranged from 1.455 tons in Kentucky to 1.831 tons in Indiana.

The blast furnaces in Ohio used chiefly Lake Superior iron ore and manganiferous iron ore, although a small quantity of low-phosphorus iron ore from Africa was also used. The consumption of ore per ton of iron made in Ohio in 1930 averaged 1.724 tons.

The furnaces in the Chicago district, including Joliet, Ill., used iron ore and manganiferous iron ore from mines in the Lake Superior district; those at Granite City, Ill., used ore chiefly from mines in the Lake Superior district, but also ore from the Iron Mountain, Rueppele, Cherry Valley, Kimble, Nicholson, and Wiggins mines in Missouri An average of 1.835 tons of ore was used to make 1 ton of pig iron in 1930.

In New York the furnaces in the Buffalo district used ores from the Lake Superior district; the furnaces at Port Henry used magnetite from the New Bed, Old Bed, and Harmony mines at Mineville, N. Y.; and the furnace at Standish used magnetite from the Chateaugay mine at Lyon Mountain, N. Y., and a small quantity of ferruginous manganese ore from Canada. In making 1 ton of pig iron the furnaces in New York used an average of 1.803 tons of ore in 1930.

The furnaces in western Pennsylvania used ore from the Lake Superior district. Those in the eastern part of the State used, in addition to some Lake ores, magnetite from the Cornwall mine in Pennsylvania; magnetites from the Beach Glen, Cannon and Peters, Mt. Hope, Washington, Scrub Oaks, and Richard mines in New Jersey; magnetites from the New Bed, Old Bed, Harmony, No. 21, Chateaugay, and Forest of Dean mines in New York; and considerable quantities of ores from Africa, Australia, Brazil, Chile, Newfoundland, Spain, and Sweden. An average of 1.66 tons of ore was used in Pennsylvania in 1930 to make 1 ton of pig iron.

The iron furnaces in Tennessee used brown ore from Wrigley and Iron City, Tenn.; hematite from the Rockwood area, Tennessee; brown ore from the Reed mine in Georgia; and iron sinter from Tennessee. An average of 2.154 tons of ore was used per ton of iron made in 1930.

Virginia iron furnaces used local hematite, brown ore, manganiferous iron ore, and pyrite cinder in 1930. These furnaces used 1.728 tons of ores per ton of iron made in 1930.

The blast furnaces at Pueblo, Colo., used brown ore from the Orient mine in Colorado; hematite from the Sunrise mine in Wyoming; magnetite from the Union Hill mine in New Mexico; manganiferous iron ores from Leadville, Colo., and Silver City, N. Mex.; and rhodochrosite from the Emma mine in Montana.

The blast furnace at Provo, Utah, used iron ore chiefly from the Desert Mound mine in the Iron Springs district, Utah. The manganiferous iron ore used was obtained from California, Idaho, Montana, Nevada, and Utah.

The following two tables show the consumption of iron ore and other metallic materials, the production of pig iron (as reported to the Bureau of Mines), and the average quantity of materials used per ton of pig iron made.

Iron ore and other metallic materials consumed and pig iron produced in 1930, by States, in gross tons

State	Metalliferous materials consumed				Pig iron produced, exclusive of ferro-alloys	Materials consumed per ton of iron made		
	Iron and manganiferous iron ores		Cinder, scale, and scrap	Total		Ores	Cinder, scale, and scrap	Total
	Domestic	Foreign						
Alabama	5,776,322	24,439	202.021	6,002,782	2,382,221	2.435	0.085	2.520
Illinois	6,138,792		348,246	6,487.038	3,346.381	1.835	.104	1.939
Indiana	5,847,604		438,684	6,286,288	3,193,629	1.831	.137	1.968
Kentucky	120,848		26,453	147,301	83,075	1.455	.318	1.773
Maryland	146,295	1,234,994	313,365	1,694,654	986,192	1.400	.318	1.718
Michigan	1,261,260		136,816	1,398,076	740,947	1.702	.185	1.887
Minnesota	487,379		59,982	547,361	270,337	1.803	.222	2.025
New York	3,334,367	919	173,212	3.508,498	1,849,515	1.803	.094	1.897
Ohio	11,535,838	7,418	1,082,527	12,625,783	6,694,770	1.724	.162	1.886
Pennsylvania	15,780,906	772,146	1,998,092	18,551,144	9,973,798	1.660	.200	1.860
Tennessee	25,230		1,167	26,397	11,710	2.154	.100	2.254
Virginia	152,084		26,369	178,453	87,992	1.728	.300	2.028
West Virginia	1,348.673		47,247	1,395,920	753,345	1.790	.063	1.853
Undistributed [1]	1,129,363	150,867	64,759	1,344,989	662.954	1.931	.098	2.029
	53,084,961	2,190,783	4,918,940	60,194,684	31,036,866	1.781	.158	1.939

[1] Includes Colorado, Massachusetts, and Utah.

Iron ore and other metallic materials consumed and pig iron produced in the United States, 1921–1930, in gross tons

Year	Metalliferous materials consumed				Pig iron produced, exclusive of ferro-alloys	Materials consumed per ton of iron made			
	Iron and manganiferous iron ores		Cinder, scale, and scrap	Total		Ores		Cinder, scale, and scrap	Total
	Domestic	Foreign				Domestic	Foreign		
1921	28,847,395	372,038	2,269,864	31,489,297	16,403,627	1.759	0.023	0.138	1.920
1922	46,485,690	910,205	4,285,187	51,681,082	26,826,210	1.733	.034	.160	1.927
1923	69,272,579	2,084,094	5,376,448	76,733,121	39,767,482	1.742	.052	.135	1.929
1924	51,880,562	2,012,689	4,646,320	58,539,571	30,869,199	1.681	.065	.150	1.896
1925	62,029,734	2,337,767	5,137,068	69.504,569	36,124,678	1.717	.065	.142	1.924
1926	65,922,601	2,442,631	6,254,523	74,619,755	38,755,698	1.701	.063	.161	1.925
1927	61,718,383	2,540,558	5,602,006	69,860,947	35,875,129	1.720	.071	.156	1.947
1928	63,795,555	2,625,620	6,026,785	72,447,960	37,410,897	1.706	.070	.161	1.937
1929	72,330,926	2,887,814	6,817,314	82,036,054	41,761,488	1.732	.069	.163	1.964
1930	53,084,961	2,190,783	4,918,940	60,194,684	31,036,866	1.710	.071	.158	1.939

Foreign iron and manganiferous iron ores consumed in the manufacture of pig iron in the United States, 1929 and 1930, by sources of ore, in gross tons

Source of ore	1929	1930	Source of ore	1929	1930
Africa	275,432	171,681	Greece		6,008
Asia	1,943	979	Newfoundland	65,581	65,854
Australia	35,536	43,632	Russia		34,445
Brazil	821	1,100	Spain	38,011	45,986
Canada		919	Sweden	185,789	95,950
Chile	1,551,529	1,510,649	Undistributed	68,948	24,273
Cuba	664,224	189,307			
				2,887,814	2,190,783

LAKE SUPERIOR DISTRICT

PRODUCTION

The total quantity of iron ore mined in the Lake Superior district, not including the Iron Ridge area in Wisconsin, amounted to 49,382,652 gross tons in 1930, a decrease of 21 per cent as compared with 1929. The output of the several ranges is shown in the following table. After 1905 the figures do not include manganiferous iron ore containing 5 per cent or more of manganese; 698,244 gross tons of this ore was mined in 1930, compared with 1,058,953 tons in 1929. The Mesabi range produced 63 per cent of the iron-ore output of the Lake Superior district and 54 per cent of the total output of the United States in 1930. The proportion contributed by this range has been remarkably uniform since 1915; for the Lake Superior district the proportion from 1915 to 1929 ranged from 63 to 71 per cent and averaged 66 per cent, and for the United States it ranged from 53 to 60 per cent and averaged 56 per cent. Thus, the proportion contributed by the Mesabi range in 1930 was about 2 points below the average for the 15-year period from 1915 to 1929. The Vermilion range was the only range to record an increase in 1930; in fact, its production in 1930 is the second largest on record, being only 3 per cent less than that for the record year (1902). Production on each of the other iron ranges decreased in 1930; the percentage decrease on the Marquette range was the smallest, and that on the Mesabi was the largest.

Iron ore mined in the Lake Superior district, 1854–1930, in gross tons

[Exclusive after 1905 of ore containing 5 per cent or more of manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854-1870	3, 971, 716						3, 971, 716
1871-1880	10, 294, 047	858, 810					11, 152, 857
1881-1890	18, 598, 012	11, 917, 416	8, 657, 807	3, 260, 426			42, 433, 661
1891-1900	27, 269, 545	21, 639, 872	23, 361, 043	12, 097, 048	32, 282, 873		116, 650, 381
1901-1910	37, 728, 143	41, 974, 789	34, 514, 899	15, 350, 581	194, 654, 902		324, 223, 314
1911-1920	40, 398, 895	51, 435, 662	60, 459, 988	13, 718, 118	334, 134, 688	11, 882, 843	512, 030, 194
1921	2, 204, 114	2, 147, 569	3, 135, 477	981, 576	16, 380, 190	449, 559	25, 298, 485
1922	2, 745, 626	3, 290, 641	4, 910, 789	1, 108, 764	26, 704, 601	955, 595	39, 716, 016
1923	3, 910, 909	4, 913, 541	6, 112, 662	1, 119, 113	41, 809, 018	1, 420, 165	59, 285, 408
1924	3, 579, 087	3, 780, 664	5, 579, 883	1, 141, 690	29, 818, 965	941, 430	44, 841, 719
1925	3, 813, 687	5, 009, 022	6, 377, 710	1, 331, 753	34, 851, 109	673, 382	52, 056, 663
1926	4, 046, 191	5, 445, 683	6, 949, 920	1, 568, 953	37, 997, 797	1, 134, 863	57, 143, 467
1927	4, 015, 730	5, 458, 182	6, 604, 830	1, 577, 817	32, 866, 034	1, 017, 287	51, 539, 880
1928	3, 755, 343	4, 855, 735	6, 342, 092	1, 628, 289	34, 856, 333	1, 079, 383	52, 517, 175
1929	4, 545, 839	5, 428, 409	7, 089, 602	1, 883, 547	42, 371, 192	1, 506, 119	62, 824, 708
1930	4, 419, 816	4, 431, 077	6, 014, 011	1, 996, 516	31, 299, 900	1, 221, 332	49, 382, 652
	175, 296, 700	172, 587, 132	186, 110, 713	58, 764, 191	890, 027, 602	22, 281, 958	1, 505, 068, 296

SHIPMENTS AND RECEIPTS

According to the Lake Superior Iron Ore Association, a total of 47,187,661 gross tons of iron ore and manganiferous iron ore was shipped in 1930 from the Lake Superior district, as compared with 66,157,359 tons in 1929. The shipments as reported to the Bureau of Mines by producers amounted to 46,471,847 gross tons of iron ore and 698,244 tons of manganiferous iron ore containing 5 per cent or more of manganese, a total of 47,170,091 tons in 1930, compared with

65,101,561 tons of iron ore and 1,058,953 tons of manganiferous iron ore, a total of 66,160,514 tons in 1929.

The iron ore received at Lake Erie ports, according to the Lake Superior Iron Ore Association, amounted to 31,779,844 gross tons, and at other than Lake Erie ports to 14,337,329 gross tons, a total of 46,117,173 tons in 1930, compared with 45,772,572 tons at Lake Erie ports and 18,779,099 tons at other than Lake Erie ports, a total of 64,551,671 tons in 1929.

STOCKS OF ORE AT LAKE ERIE PORTS

Stocks of iron ore at lower Lake ports at the end of the shipping season are important because of their bearing on the manufacture of pig iron during the following winter and spring. According to the Lake Superior Iron Ore Association, at the close of navigation in 1930, 6,466,326 gross tons of iron ore was in stock at Lake Erie ports, compared with 6,489,612 tons on the corresponding date in 1929. At the opening of navigation in May, 1931, 5,429,721 tons of ore was in stock at these ports, indicating a withdrawal of 1,036,605 tons during the winter of 1930–31. The average quantity withdrawn each winter during the preceding five years was about 2,593,000 tons.

PRICES OF LAKE SUPERIOR ORE

The price of iron ore per unit of iron in the natural state for the four standard grades of Lake Superior ore for the last 17 years is shown in Steel.[5] The base of Bessemer ore, old-range and Mesabi, for 1925 to 1930, is a metallic iron content of 51.5 per cent, natural, instead of 55 per cent as for 1924 and many earlier years. The base of non-Bessemer ore, old-range and Mesabi, remains as heretofore at 51.5 per cent, natural. The unit prices established April 1, 1930, are the same as those for 1929 and are as follows: Old-range Bessemer, 9.32 cents; Mesabi Bessemer, 9.029 cents; old-range non-Bessemer, 9.029 cents; and Mesabi non-Bessemer, 8.738 cents. The prices per ton that correspond to these prices are, respectively, $4.80, $4.65, $4.65, and $4.50. The lowest prices ever quoted for these ores were $2.60 for old-range Bessemer in 1897, $2.15 for Mesabi Bessemer in 1895, $1.85 for old-range non-Bessemer in 1898, and $1.75 for Mesabi non-Bessemer in 1898.

IRON-ORE RESERVES

Estimates of ore reserves for Minnesota, furnished by the Minnesota Tax Commission, and for Michigan, furnished by the Michigan Board of State Tax Commissioners, cover developed and prospective ore in the ground and ore in stock piles. These estimates show a decrease from the previous year of about 6,832,000 gross tons in Minnesota but an increase of about 2,638,000 tons in Michigan.

Iron-ore reserves in Minnesota May 1, 1926–1930, in gross tons

Range	1926	1927	1928	1929	1930
Mesabi	1, 233, 979, 351	1, 201, 054, 119	1, 190, 480, 901	1, 178, 855, 601	1, 154, 434, 031
Vermilion	12, 382, 725	12, 126, 490	14, 483, 285	14, 939, 704	14, 250, 540
Cuyuna	51, 090, 529	49, 652, 592	53, 268, 438	48, 264, 579	66, 542, 939
	1, 297, 452, 605	1, 262, 833, 201	1, 258, 232, 624	1, 242, 059, 884	1, 235, 227, 510

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[5] Steel: Vol. 86, Apr. 10, 1930, p. 110.

Iron-ore reserves in Michigan January 1, 1927–1931, in gross tons

Range	1927	1928	1929	1930	1931
Gogebic	53,342,720	48,681,075	48,587,126	51,347,176	51,143,511
Marquette	63,612,812	60,219,781	57,920,862	55,655,383	57,665,510
Menominee (including Iron River and Crystal Falls districts)	67,103,492	64,752,677	62,922,419	61,347,264	62,178,324
	184,059,024	173,653,533	169,430,407	168,349,823	170,987,345

IRON-ORE MINING, BY STATES

LAKE SUPERIOR DISTRICT

The outstanding features of mining developments in the Lake Superior iron-mining districts are described in articles published in trade and mining journals.[6]

Michigan.—Mining activity on the Michigan ranges in 1930 was on a considerably reduced scale, as is shown by a production of 13,544,277 gross tons, compared with 15,456,397 tons in 1929. The production in 1930 was made by 60 mines in five counties, as the following table shows.

Iron ore mined in Michigan, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Baraga	1	91,374	1	89,342
Dickinson	5	1,289,150	5	1,155,994
Gogebic	17	5,553,199	17	4,760,565
Iron	20	4,068,209	21	3,207,902
Marquette	15	4,454,465	16	4,330,474
	58	15,456,397	60	13,544,277

The ore reserves in Michigan on January 1, 1931, amounted to 170,987,345 gross tons, an increase from the previous year of 2,637,522 tons—evidence that new discoveries for the first time since 1926 more than kept pace with production. During the last 10 years the reduction in reserves in Michigan has amounted to only 28,757,000 gross tons, notwithstanding the fact that during this 10-year period a total of about 132,236,000 tons of ore has been shipped. Thus, new ore discoveries amounting to about 103,479,000 tons are indicated during the last 10 years.

The Norrie-Aurora mine in Gogebic County had the largest output of any mine in Michigan in 1930, producing 950,349 tons. Of the 60 active mines in Michigan in 1930, 48 yielded more than 100,000 tons each. The average production per mine in Michigan was 225,738 tons in 1930, compared with 266,490 tons in 1929.

A report on the iron-ore mines of Michigan for 1930, published by the geological survey division of the Michigan Department of Conservation,[7] shows that the average number of men employed per day was 8,554, the average number of days worked underground and in open pits was 287, the average daily wage was $4.997, the average yearly earning was $1,436.55, and the tons of ore mined per man per day was 5.49.

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[6] Haun, A. J., Iron Mine Operators Prepare for More Active Season: Steel, vol. 88, Jan. 8, 1931, pp. 46–48; Skillings' Mining Rev. (various issues, particularly issues of Jan. 31 and Feb. 7, 1931).

[7] Pardee, F. G., and Osgood, W., General Statistics Covering Costs and Production of Michigan Iron Mines. Geol. Survey Div., Dept. of Conservation (Lansing), 1931.

The following table on average per-ton costs of mining ore at underground mines and at siliceous open pits has been condensed from statistics published in much greater detail by the geological survey division of the Michigan Department of Conservation.

Average per-ton costs of mining iron ore at underground mines and at siliceous open pits in Michigan in 1930

Item	Underground					Siliceous open pits
	Dickinson	Gogebic	Iron	Marquette	Total	
Cost of mining	$2.0335	$1.5715	$1.3740	$1.5771	$1.5637	$0.4076
Deferred mining costs	.0303	.1599	.0382	.0727	.0882	.0349
Taxes	.2189	.3285	.2313	.2437	.2661	.0694
General overhead	.1663	.2131	.2335	.2209	.2168	.1204
Transportation	1.4532	1.6584	1.4659	1.4030	1.5270	1.4019
Marketing	.0460	.0290	.0733	.0916	.0607	.0937
Total ore cost	3.9482	3.9604	3.4162	3.6090	3.7225	2.1279
Lake Erie value per ton	4.5320	4.8366	4.3497	4.7881	4.6610	2.3081
Gross ore profit [1]	.5838	.8762	.9335	1.1791	.9385	.1802

[1] This figure does not represent true profit, as much ore is sold at a discount; it also excludes royalty and interest on borrowed money.

The mining practices and methods used in producing soft hematite at Mine No. 5[8] and in producing semihard hematite at Mine No. 4,[9] both on the Marquette range, are described by Graff, who also gives detailed figures on the cost of mining the ore. The mining methods employed at the Eureka-Asteroid mine[10] on the Gogebic range are described by Schaus, who also gives detailed figures on the cost of mining the ore.

Minnesota.—Mining activities in Minnesota were on a considerably reduced scale in 1930, the production of 34,517,748 gross tons representing a decrease of 25 per cent from 1929. The output in 1930 was made by 84 mines in three counties, as the following table shows.

Iron ore mined in Minnesota, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Crow Wing	9	1,506,119	9	1,221,332
Itasca	23	8,743,189	27	7,510,593
St. Louis	53	35,511,550	48	25,785,823
	85	45,760,858	84	34,517,748

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[8] Graff, W. W., Mining Practices, Methods, and Costs at Mine No. 5 of the Marquette Range, Mich.: Inf. Circ. 6380, Bureau of Mines, November, 1930, 10 pp.

[9] Graff, W. W., Mining Practices, Methods, and Costs at Mine No. 4 of the Marquette Range, Mich.: Inf. Circ. 6390, Bureau of Mines, December, 1930, 8 pp.

[10] Schaus, O. M., Method and Cost of Mining Hematite at the Eureka-Asteroid Mine on the Gogebic Range, Gogebic County, Mich.: Inf. Circ. 6348, Bureau of Mines, September, 1930, 13 pp.

The reserves of ore in Minnesota on May 1, 1930, amounted to 1,235,227,510 gross tons, a decrease of 6,832,374 tons from the previous year, indicating that new discoveries for the sixth consecutive year were not enough to keep pace with production. During the last 10 years the reduction in reserves in Minnesota has amounted to only 76,132,000 tons, although shipments have amounted to about 364,141,000 tons, indicating that the ore added by new discoveries, by the extension of deposits beyond the arbitrary limits imposed by mine appraisers, and by the inclusion of deposits not previously considered merchantable has amounted to about 288,000,000 tons during that time.

In 1930 the largest producing mine in Minnesota, as well as in the United States, was the Missabe Mountain, an open-pit operation in St. Louis County, which yielded 2,943,016 gross tons. The Hull-Rust and Sellers mines, also open-pit operations in St. Louis County, yielded 2,642,171 tons and 2,291,131 tons, respectively, in 1930. The Hull-Rust mine, which for many years was world famed as the largest producer, has yielded 100,427,976 tons. Of the 84 active mines in Minnesota in 1930, 65 yielded more than 100,000 tons each. The average production per mine in Minnesota in 1930 was 410,926 tons, compared with 538,363 tons in 1929.

According to the annual report of the mine inspector of St. Louis County, an average of 7,752 men was employed in iron-ore mines in St. Louis County during 1930 and the average daily wage was $5.33, as compared with an average of 8,008 men employed and an average daily wage of $5.33 also in 1929. In 1930, 8,368,554 cubic yards of stripping were removed from mines in St. Louis County, as compared with 7,160,463 cubic yards in 1929.

According to the annual report of the mine inspector of Itasca County, an average of 4,393 men was employed in iron-ore mines in Itasca County during 1930, the average daily wage was $5.38, and 8,249,971 cubic yards of stripping were removed.

The mining methods used in producing iron ore from an underground operation in the central-western part of the Mesabi range [11] are described by Haselton, who also gives detailed figures on the cost of mining the ore.

Wisconsin.—The production of iron ore in Wisconsin in 1930 was 1,321,360 gross tons, a decrease of 18 per cent from 1929. This output was made by four mines in three counties, as the following table shows.

Iron ore mined in Wisconsin, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Dodge	1	1,058	1	733
Florence	1	71,110	1	67,181
Iron	2	1,536,403	2	1,253,446
	4	1,608,571	4	1,321,360

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[11] Haselton, W. D., Underground Mining Practice and Costs at a Mesabi Range (Minn.) Mine Using the Top-Slicing System: Inf. Circ. 6325, Bureau of Mines, July, 1930, 11 pp.

The chief producing mine in Wisconsin in 1930, as for many years past, was the Montreal mine in Iron County, which yielded 1,043,097 gross tons. The mining methods employed at the Montreal mine[12] are described by Schaus, who also gives detailed figures on the cost of mining the ore.

Iron-ore analyses.—The iron content of the ore shipped from the Lake Superior district in 1930 averaged 51.33 per cent, natural, compared with 51.18 per cent in 1929 and 51.15 per cent in 1928, showing how closely these ores are graded. The percentages of phosphorus and moisture decreased slightly, and the percentages of silica and manganese increased.

The following table, compiled by the Lake Superior Iron Ore Association, summarizes the average analyses of the total tonnages of all grades of ore shipped and shows the remarkable uniformity maintained during the past 10 years.

Average analyses of total tonnages of all grades of iron ore from all ranges of Lake Superior district, 1921–1930

Year	Gross tons	Iron (natural)	Phosphorus	Silica	Manganese	Moisture
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1921	22,523,989	52.07	0.087	8.23	0.62	10.95
1922	43,431,294	51.87	.099	8.23	.76	10.78
1923	60,024,176	51.79	.095	8.22	.79	10.76
1924	43,276,165	51.72	.100	8.45	.76	10.75
1925	54,784,355	51.74	.099	8.42	.82	10.58
1926	59,151,368	51.75	.101	8.35	.80	10.78
1927	51,730,711	51.19	.105	8.60	.84	11.31
1928	54,045,941	51.15	.099	8.43	.85	11.37
1929	65,443,546	51.18	.100	8.48	.80	11.24
1930	46,698,554	51.33	.095	8.70	.82	10.92

During this 10-year period the iron content ranged from 51.15 to 52.07 per cent, the phosphorus from 0.087 to 0.105 per cent, the silica from 8.22 to 8.7 per cent, the manganese from 0.62 to 0.85 per cent, and the moisture from 10.58 to 11.37 per cent. This uniformity does not, of course, mean that the average grade of the available Lake Superior iron ore is not declining. The grade of shipments has been maintained by methods of beneficiation, which are ever becoming more elaborate, and by mixing ores from different deposits.

SOUTHEASTERN STATES

Alabama.—The production of iron ore in Alabama in 1930 amounted to 5,738,478 gross tons, a decrease of 11 per cent from 1929. This output was made by 23 mines in eight counties, as the following table shows.

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[12] Schaus, O. M., Mining Methods and Costs at the Montreal Mine, Montreal, Wis.: Inf. Circ. 6369, Bureau of Mines, November, 1930, 29 pp.

Iron ore mined in Alabama, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Blount	5	228, 064	4	177, 554
Calhoun	3	2, 581		
Etowah	1	12, 769		
Franklin	2	143, 374	2	165, 090
Jefferson	6	5, 814, 143	5	5, 151, 089
Shelby			1	50, 000
Tuscaloosa	4	239, 358	3	173, 041
Coosa			1	5, 465
Cherokee	4	5, 556	2	
Talladega	2	7, 230	5	16, 239
Butler	1			
	28	6, 453, 075	23	5, 738, 478

The ore produced in Blount County in 1930 was brown ore, all of which was washed, screened, picked, and jigged; the iron content of the concentrates averaged 50 per cent (dried), the manganese averaged 0.8 per cent, and the phosphorus averaged 0.4 per cent. The brown ore concentrates from the Russellville district in Franklin County averaged 50.1 per cent of iron (dried), 0.65 per cent of manganese, and 0.6 per cent of phosphorus. Tuscaloosa County was the largest producer of brown ore in Alabama in 1930; the iron content (dried) of the concentrates averaged 47.82 per cent, the manganese content averaged 1.31 per cent, and the phosphorus content averaged 0.32 per cent. The brown ore concentrates produced in Shelby County averaged 50 per cent of iron (dried), 0.8 per cent of manganese, and 0.2 per cent of phosphorus.

Most of the ore mined in Alabama is hematite, much of which contains enough lime to make it self-fluxing or nearly so. Hematite was produced only in Jefferson County in 1930; the iron content of that shipped in 1930 ranged from 33.03 to 38.5 per cent (natural) and averaged 36.61 per cent.

Georgia.—The production of iron ore in Georgia in 1930 was 52,221 gross tons, a decrease of 12 per cent from 1929. This output was made by five mines in two counties, as the following table shows.

Iron ore mined in Georgia, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Bartow	1	8, 725	1	13, 934
Polk	5	50, 591	4	38, 287
	6	59, 316	5	52, 221

All the ore from Georgia in 1930 was washed brown ore; the iron content (dried) of the concentrates averaged about 51 per cent. Most of this ore was mined from the Cedartown area in Polk County; the remainder was from the Cartersville district in Bartow County.

Tennessee.—The production of iron ore in Tennessee was 27,710 gross tons, as compared with 102,171 tons in 1929, a decrease of 73 per cent. This large decrease is due chiefly to the inactivity of the mines near Rockwood, Roane County. The output in 1930 was made by three mines in three counties, as the following table shows.

Iron ore mined in Tennessee, 1929 and 1930, by counties

County	1929		1930	
	Active mines	Gross tons	Active mines	Gross tons
Dickson	2	8,880		
Hickman	1	24,536	1	23,277
Lawrence			1	4,107
Hamilton	1	68,755	1	326
Roane	1			
	5	102,171	3	27,710

The ore mined in Tennessee in 1930 was chiefly brown ore, mined at the Johnson mine in Hickman County and the Van Leer mine in Lawrence County. The ore from these mines is hand picked, washed, and jigged, and the iron content (dried) of the concentrates recovered in 1930 averaged 52.33 and 48 per cent, respectively. A small quantity of hematite used for paint was mined at a deposit near Ooltewah, Hamilton County, in 1930.

A considerable quantity of iron sinter, recovered from copper sulphide ore mined in Polk County, was shipped in 1930; this sinter averaged 64.51 per cent of iron, 0.12 per cent of manganese, and 0.007 per cent of phosphorus. These shipments are not included in the statistics of iron ore.

Virginia.—The production of iron ore in Virginia in 1930 was 19,596 gross tons, as compared with no production in 1929. The Porter mine in Wythe County was the only productive mine in Virginia in 1930. Shipments were also made from the stock pile at the Oriskany mine in Botetourt County in 1930.

MISSOURI

The production of iron ore in Missouri in 1930 was 132,749 gross tons, a decrease of 21 per cent from 1929. The output in 1930 consisted chiefly of hematite mined at the Rueppele mine in Franklin County, the Iron Mountain mine in St. Francois County, the Cherry Valley mine in Crawford County, the Wiggins mine in Dent County, and the "Kimble" mine in Texas County. The iron content (dried) of the hematite ranged from 50.12 to 58 per cent and averaged 51.23 per cent. Small quantities of brown ore were mined in Texas and Washington Counties in 1930. Most of the ore from these mines in 1930 was shipped to the blast furnaces at Granite City, Ill. The Missouri production, however, was only about one-fourth of the ore requirements of these furnaces, the larger part of the ore they consumed being obtained from the Lake Superior district.

NORTHEASTERN STATES

New Jersey.—The production of iron ore in New Jersey in 1930 was 394,639 gross tons, an increase of 40 per cent over 1929. The production in 1930 was from the Mt. Hope, Scrub Oaks, Beach Glen, and Richard mines in Morris County, the Washington mine in Warren County, and the Cannon and Peters mines in Passaic County. All the ore produced in New Jersey in 1930 was concentrated; the iron content of the concentrates shipped ranged from 59.61 to 64.51 per cent and averaged 62.48 per cent. Some ore from the stock pile at the Ahles mine in Warren County was sold for use in gas purification

The Mt. Hope mine was again the largest producer of iron ore in New Jersey, with an output of 118,140 tons of concentrates. A novel and money-saving method of drilling at the Mt. Hope mine is reported to have been developed in the last few years. By its use the tonnage broken per man-shift has been increased from 15.5 to more than 60. This increase has been an important factor in keeping the mine running without a shutdown. The drilling method used at the Mt. Hope mine has been described in much detail by Radel,[13] who says there seems to be no reason why operators should not use it to advantage in other districts where the character of the ground and stoping conditions permit.

The Washington mine in Warren County and the Scrub Oaks (formerly Replogle) mine in Morris County, both inactive since 1923, were reopened in 1930. The crude ore from these and other magnetite mines in New Jersey is treated in either dry or wet magnetic separating plants; the Washington mine uses the dry method and the Scrub Oaks mine uses the wet method. The concentrator at the Scrub Oaks mine has been described in some detail by Skillings.[14]

New York.—The production of iron ore in New York in 1930 was 889,405 gross tons, an increase of 8 per cent over 1929. Operations at the Harmony, New Bed, and Old Bed mines at Mineville, Essex County, were on an increased scale in 1930, about 22 per cent more crude ore being mined than in 1929. The product shipped from these mines in 1930 consisted of 181,105 tons of sinter averaging 68.34 per cent of iron, 0.04 per cent of manganese, and 0.13 per cent of phosphorus; 252,127 tons of concentrates averaging 67.93 per cent of iron, 0.04 per cent of manganese, and 0.09 per cent of phosphorus; and 72,604 tons of lump ore averaging 62.12 per cent of iron, 0.10 per cent of manganese, and 0.99 per cent of phosphorus. The Chateaugay mine in Clinton County also yielded about 22 per cent more crude ore in 1930 than in 1929; all the ore from this mine is sintered, and the sinter shipped in 1930 averaged 65.5 per cent of iron, 0.09 per cent of manganese, and 0.005 per cent of phosphorus. The Forest of Dean mine in Orange County yielded about 22 per cent less magnetite concentrates in 1930 than in 1929; the concentrates shipped in 1930 averaged about 62 per cent of iron. New York is the largest producer of iron ore for use in paint. The ore, known as Clinton hematite, was mined in 1930 in Oneida and Wayne Counties.

Pennsylvania.—Pennsylvania, the largest source of magnetite in the United States, produced 964,638 gross tons of ore in 1930, a decrease of 12 per cent from 1929. The magnetite shipped in 1930 averaged 42.21 per cent of iron (natural). Some carbonate ore for use in paint was mined in Carbon County in 1930.

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[13] Radel, F. M., The Mount Hope Drilling Method: Eng. and Min. Jour., vol. 130, July 24, 1930, pp. 75-79.

[14] Skillings, D. N., New Concentrator at Replogle Mine: Skillings' Mining Rev., Oct. 25, 1930, p. 6.

WESTERN STATES

Arizona.—A small quantity of magnetite, averaging about 60 per cent of iron, was produced at the Excelsior mine in Yuma County in 1930. Most of this ore was shipped for use in steel plants, but a little was sold for use in hydrogen gas.

Colorado.—The production of brown ore in Colorado in 1930 was 32,247 gross tons, a decrease of 36 per cent from 1929. This ore was mined at the Orient mine in Saguache County and averaged (natural) 43.3 per cent of iron, 1.43 per cent of manganese, and 0.026 per cent of phosphorus.

New Mexico.—The production of iron ore, all magnetite, in New Mexico in 1930 was 173,432 gross tons, an increase of 1 per cent over 1929. The ore mined in 1930 consisted of 170,911 tons from the Union Hill mine and 2,521 tons from the Cupola mine, both in Grant County. The magnetite from the Union Hill mine in 1930 averaged (natural) 51.42 per cent of iron, 0.61 per cent of manganese, and 0.055 per cent of phosphorus. The ore from the Cupola mine averaged slightly higher in these constituents. Nearly all of the iron ore from these mines is shipped to Pueblo, Colo., a distance of 694 miles. This long transportation by rail made it necessary to develop economical methods of mining to make the operation profitable. These methods have been described by Kniffin.[15]

Utah.—The production of iron ore in Utah in 1930 was 279,118 gross tons, a decrease of 14 per cent from 1929. The ore produced in Utah in 1930 was chiefly hematite from the Desert Mound mine near Iron Springs, Iron County; it averaged (natural) 52 per cent of iron, 2.3 per cent of manganese, and 0.29 per cent of phosphorus. The plant and equipment for handling the ore from the Desert Mound mine have been described in the Salt Lake Mining Review.[16] Small quantities of iron ore were produced at the Iron King mine in Utah County and at the Tecoma mine in Box Elder County.

Wyoming.—The production of iron ore in Wyoming in 1930 was 320,023 gross tons, a decrease of 50 per cent from 1929. The output was from the Sunrise mine in Platte County. The ore is hematite; that shipped in 1930 averaged (natural) 52.8 per cent of iron, 0.13 per cent of manganese, and 0.067 per cent of phosphorus.

FOREIGN TRADE IN IRON ORE

IMPORTS AND EXPORTS

The iron ore imported into the United States in 1930 amounted to 2,775,124 gross tons, valued at $8,113,039, as compared with 3,139,334 tons, valued at $8,145,354, in 1929; these figures represent decreases in 1930 of 12 per cent in quantity and 0.4 per cent in total value. The imports of iron ore in 1930 were the second largest ever recorded. Chile continued to be the chief source of imports, furnishing 61 per cent of the total in 1930. The other main sources of imported ore in 1930 were Africa, Australia, Cuba, and Sweden; 31 per cent of the total came from these countries. The substantial increases in imports from Africa, Australia, and Spain, the large decrease in imports from Cuba and substantial decreases from Egypt and Sweden, and the importation of 63,412 gross tons of iron ore from Soviet Russia in Europe in 1930 are noteworthy.

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[15] Kniffin, L. M. Mining and Engineering Methods and Costs of the Hanover Bessemer Iron & Copper Co., Fierro, N. Mex.: Inf. Circ. 6361, Bureau of Mines, November, 1930, 20 pp.

[16] Salt Lake Mining Review, Iron Ore Production by the Utah Iron Ore Corporation; Description of Plant and Equipment for Handling Ore: Vol. 28, July 30, 1926, pp. 9-11.

Iron ore imported into the United States, 1928-1930, by countries

Country	1928		1929		1930	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Africa:						
Algeria and Tunisia	159, 860	$1, 550, 643	171, 995	$570, 852	232, 265	$836, 333
Morocco					5, 170	15, 074
Mozambique					1	15
Australia	18, 115	58, 516	41, 798	132, 161	219, 926	679, 236
Brazil	31, 805	229, 179	46, 070	279, 367	24, 507	93, 768
Canada	13, 309	44, 623	3, 542	14, 502	395	2, 767
Chile	1, 434, 860	1, 579, 119	1, 699, 066	2, 462, 738	1, 689, 071	4, 051, 301
Costa Rica	(1)	10				
Cuba	369, 286	1, 416, 561	641, 350	2, 334, 635	190, 654	781, 301
Egypt	14, 080	89, 964	77, 690	471, 077	6, 925	44, 885
France	30	206				
Germany	2, 523	8, 384	545	1, 656	295	5, 748
Greece			12, 750	52, 362		
India, British			8, 000	27, 239	7, 170	24, 425
Jamaica	81	1, 620				
Japan	6	133				
Mexico					157	286
Newfoundland and Labrador	37, 048	144, 595	76, 340	317, 294	48, 771	202, 006
Persia	1, 750	31, 936			2, 500	48, 665
Soviet Russia in Europe	(1)	2			63, 412	136, 228
Spain	37, 420	134, 113	48, 885	262, 326	81, 012	255, 041
Sweden	26, 558	107, 773	310, 406	1, 221, 508	202, 748	952, 925
United Kingdom	5, 915	30, 662	916	17, 618	145	3, 055
Venezuela			1	19		
	2, 452, 646	5, 428, 019	3, 139, 334	8, 145, 354	2, 775, 124	8, 113, 039

[1] Less than 1 ton.

Iron ore imported into the United States, 1872–1930, in gross tons

1872–1880	1, 188, 267	1925	2, 190, 697
1881–1890	7, 663, 630	1926	2, 555, 441
1891–1900	5, 869, 757	1927	2, 620, 717
1901–1910	11, 798, 568	1928	2, 452, 646
1911–1920	14, 037, 731	1929	3, 139, 334
1921	315, 768	1930	2, 775, 124
1922	1, 135, 156		
1923	2, 768, 430		62, 558, 321
1924	2, 047, 055		

Exports of iron ore from the United States in 1930 amounted to 752,267 gross tons, valued at $2,734,168, or $3.63 a ton, as compared with 1,304,417 tons, valued at $4,774,842, or $3.66 a ton, in 1929; these figures represent decreases in 1930 of 42 per cent in quantity and 43 per cent in total value. The exports of iron ore in 1930 were the smallest since 1925. As usual, practically all the iron ore exported in 1930 went to Canada.

Iron ore exported from the United States, 1929 and 1930, by countries

Country	1929		1930	
	Gross tons	Value	Gross tons	Value
Canada	1, 295, 178	$4, 741, 457	752, 088	$2, 731, 636
China	25	120		
Cuba	27	732	28	401
Mexico			7	84
Panama			51	1, 314
Philippine Islands			89	700
Poland and Danzig			4	33
Sweden	1	15		
United Kingdom	9, 186	32, 518		
	1, 304, 417	4, 774, 842	752, 267	2, 734, 168

Iron ore exported from the United States, 1899–1930, in gross tons

1899–1900	92,125	1926	868,710
1901–1910	2,713,397	1927	898,793
1911–1920	9,979,792	1928	1,282,306
1921	440,106	1929	1,304,417
1922	602,194	1930	752,267
1923	1,116,932		
1924	595,413		21,276,973
1925	630,521		

IRON-ORE MINING IN CUBA

The iron ore shipped from Cuba to the United States in 1930 amounted to 187,264 gross tons, as compared with 671,320 tons in 1929, a decrease of 72 per cent. The shipments in 1930 were the smallest since 1921. The shipments in 1930 were 86.4 per cent of hematite, including a little magnetite, from the Daiquiri and Juragua mines on the southern coast and 13.6 per cent of brown ore from the Mayari mines near the northern coast. In 1930 the hematite (dried at 212° F.) contained 57.71 per cent of iron, whereas the brown ore (nodulized) carried 55.61 per cent. In 1929 the hematite (dried) averaged 56.31 per cent, whereas the brown ore (nodulized) averaged 55.49 per cent.

The total stock of ore (natural and nodulized) reported on hand at the end of 1930 was 484,056 gross tons, compared with 384,547 tons at the end of 1929, an increase of 26 per cent.

The following table shows the shipments of iron ore from Cuba since the opening of the mines in 1884. The statistics of the shipments of Cuban iron ore are collected by the Bureau of Mines.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1930, in gross tons

Year	Juragua (hematite and magnetite)	Daiquiri (hematite and a little magnetite)	Sigua (hematite)	Mayari (brown ore)	Guamá (hematite)	El Cuero (hematite)	Total
1884–1890	1,142,519						1,142,519
1891–1900	[1] 2,348,473	[2] 979,992	20,438				3,348,903
1901–1910	2,104,186	[3] 4,456,440		307,700	41,241	224,729	7,134,296
1911–1919	1,836,037	2,833,102		3,034,015		678,374	8,942,796
1920	561,268						
1921	130,359						130,359
1922	444,794						444,794
1923	674,371						674,371
1924	283,094			11,461			294,555
1925	514,040			44,127			558,167
1926	528,647			49,444			578,091
1927	348,607			66,240			414,847
1928	340,404			54,016			394,420
1929	601,322			69,998			671,320
1930	161,799			25,465			187,264
	20,289,454		20,438	3,662,466	41,241	903,103	24,916,702

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[1] Of this quantity, 5,932 tons sent to Pictou, Nova Scotia.
[2] Of this quantity, 51,537 tons sent to ports outside of the United States.
[3] Of this quantity, 12,691 tons sent to ports outside of the United States.

WORLD PRODUCTION OF IRON ORE, BY COUNTRIES

The following table shows the production of iron ore by countries for 1926 to 1930, so far as figures are obtainable. Figures for preceding years appear in earlier volumes of Mineral Resources. Complete returns for 1930 are not yet available, but those for 1929 and earlier years are fairly complete. Thus, the figures for 1929 indicate a total world production of about 200,000,000 metric tons, of which the United States furnished about 37 per cent. In 1928 the United States contributed about 36 per cent of the world total, which apparently was 174,000,000 metric tons.

Iron ore produced, 1926–1930, by countries, in metric tons

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
North America:					
Cuba [1]	587,369	421,505	400,750	682,095	190,270
Mexico	92,982	64,000	80,293	112,749	(2)
Newfoundland [3]	879,603	1,356,851	1,572,725	1,541,334	1,196,856
United States	68,708,349	62,732,045	63,195,351	74,199,815	59,346,123
South America:					
Brazil [4]	30,000	30,000	30,000	30,000	30,000
Chile [5]	1,476,355	1,516,440	1,515,203	1,812,343	1,695,089
Europe:					
Austria	1,094,372	1,598,570	1,928,182	1,891,381	1,180,451
Belgium	144,980	180,890	164,420	155,670	(2)
Czechoslovakia	1,421,174	1,590,527	1,779,176	1,807,603	1,652,920
France	39,317,700	45,670,920	49,191,300	50,731,100	48,820,526
Germany [6]	4,594,937	6,315,186	6,296,261	6,191,232	(2)
Greece	126,624	123,865	166,868	253,025	(2)
Hungary	132,309	194,400	199,547	251,860	157,421
Italy	504,556	503,290	625,488	715,171	718,124
Luxemburg	7,756,240	7,266,249	7,026,832	7,571,206	6,649,372
Netherlands		1,000	1,100	900	(2)
Norway	212,661	479,334	662,708	746,112	(2)
Poland	316,847	546,370	736,755	659,568	476,846
Portugal	1,640	7,600	14,000	11,126	(2)
Rumania	102,799	97,138	83,869	90,014	(2)
Russia [7]	3,415,278	4,791,530	5,911,456	[8] 7,100,000	[8] 10,148,500
Spain	3,181,589	4,960,394	5,771,207	6,546,648	5,408,180
Sweden	8,465,914	9,660,977	4,668,801	11,467,551	(2)
Switzerland [9]	49,995	81,661	65,702	88,445	(2)
United Kingdom—					
Great Britain [10]	4,160,101	11,386,467	11,443,083	13,427,043	11,813,850
Northern Ireland	(2)	5,303	819	700	(2)
Yugoslavia	366,624	336,099	439,481	427,946	431,189
Asia:					
China	[4] 1,700,000	1,710,135	[4] 1,700,000	[4] 1,700,000	[4] 1,700,000
Chosen	351,575	483,996	504,375	551,814	532,497
India, British	1,685,927	1,876,375	2,088,991	2,467,533	(2)
Japan	130,420	159,005	157,706	(2)	(2)
Russia [7]	15,154	21,476	12,970	(8)	(8)
Unfederated Malay States—Johore	254,100	416,548	654,981	755,138	714,081
Africa:					
Algeria	1,629,425	2,004,189	1,985,626	2,196,182	2,231,838
Belgian Congo	113,511	78,000	51,000	50,000	14,000
Madagascar	1	(11)			(2)
Morocco—					
French		1,050		(2)	(2)
Spanish [9]	467,350	997,111	1,060,709	1,061,424	752,715
Rhodesia—					
Northern		3,474	4,538	3,613	10
Southern	1,923	477	3,112	3,406	2,524
South-West Africa	17,869	21,753	29,929	28,697	39,969
Tunisia	582,000	915,000	909,000	977,000	828,000
Union of South Africa [1]	47,200	77,523	20,898	38,270	51,662
Oceania:					
Australia—					
New South Wales [12]	159,788	182,999	85,558	(2)	(2)
Queensland	4,483	515		1,256	2,456
South Australia	593,114	731,020	628,240	861,420	943,293
New Zealand	8,122	6,997	12,929	8,172	(2)

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[1] Shipments.
[2] Data not available.
[3] Shipments from Wabana mines.
[4] Approximate production.
[5] Production of Tofo mines.
[6] Exclusive of manganiferous iron ore carrying 12 to 30 per cent of manganese.
[7] Year ended Sept. 30.
[8] Russia in Asia included with Russia in Europe.
[9] Exports.
[10] Exclusive of bog ore, which is used mainly for the purification of gas.
[11] 175 kilograms.
[12] Exclusive of iron oxide used for paint.

BENEFICIATED IRON ORE

In 1930 the processes reported in use in the United States to improve the quality of the ore at the mines were crushing and screening, drying, hand picking, washing, jigging, electromagnetic separation, and sintering. Some operators combined two or more of these processes. Beneficiation of iron ore was reported at 70 mines in 10 States in 1930 and at 65 mines (revised figures) in 10 States also in 1929. Some iron ore is recovered in the form of dust from blast furnaces, but no statistics on it have been gathered; ore so recovered, however, has been originally included in the statistics of shipments from the mines.

Beneficiated ore shipped from mines in the United States in 1930 amounted to 8,863,344 gross tons, valued at $26,851,945, decreases of 6 per cent in quantity and 4 per cent in total value as compared with 1929. Such figures as are available for 1930 to show the relation between crude ore treated and beneficiated ore recovered indicate that in washing brown ore the ratios, by weight, of crude ore washed to resultant concentrates range from 7:1 to 2.838:1, in concentrating hematite from 3.199:1 to 1.023:1, in concentrating magnetite from 2.53:1 to 1.093:1, and in concentrating carbonate 1.249:1.

The quantity of crude ore beneficiated in the Lake Superior district in 1930 amounted to 11,275,933 gross tons and the beneficiated ore recovered was 6,335,659 tons—a loss of 4,940,274 tons and a ratio of 1.78:1. In 1929 the crude Lake ore treated amounted to 11,302,715 tons (revised figures) and the beneficiated ore recovered therefrom was 6,518,996 tons—a loss of 4,783,719 tons and a ratio of 1.734:1.

Beneficiated iron ore shipped from mines in the United States, 1929 and 1930

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

State	Variety	1929		1930	
		Gross tons	Value	Gross tons	Value
Alabama	Brown ore	623, 557	$1, 553, 688	586, 878	$1, 522, 678
Georgia	do	58, 250	172, 345	52, 221	147, 964
Minnesota	Hematite	[1] 6, 522, 742	[1] 16, 998, 564	6, 316, 111	16, 735, 527
Missouri	Hematite, brown ore	137, 181	(2)	97, 212	(2)
New Jersey	Magnetite	283, 953	1, 150, 948	390, 999	1, 629, 655
New Mexico	do	171, 585	(2)	127, 205	(2)
New York	do	875, 564	3, 941, 985	755, 074	3, 663, 155
Pennsylvania	do	644, 799	3, 114, 379	490, 664	2, 394, 440
Tennessee	Hematite, brown ore	101, 796	234, 827	27, 384	76, 089
Virginia	Brown ore			19, 596	(2)
Washington	Magnetite	5, 018	(2)		
Undistributed			912, 113		682, 437
		[1] 9, 424, 445	[1] 28, 078, 849	8, 863, 344	26, 851, 945

[1] Revised figures.

[2] Included under "Undistributed."

The next table gives the shipments of beneficiated iron ore beginning with 1914, the first year for which statistics were gathered, and the percentage of beneficiated ore to the total ore shipped. Except for a few years the increase in the tonnage of beneficiated ore shipped has been slow but steady. During the 5-year period 1914 to 1918 the shipments of beneficiated ore averaged 10.6 per cent of the total ore; during the next 5-year period (1919 to 1923) they increased to 13.5 per cent; and during the following 5-year period (1924 to 1928) they decreased to 13.2 per cent. In 1929 they decreased further to 12.5 per cent, but in 1930 they increased to 16.1 per cent.

Iron ore shipped from mines in the United States, 1914–1930, in gross tons, and percentage of beneficiated ore to the total shipped

[Exclusive of ore containing 5 per cent or more of manganese and of ore sold for paint]

Year	Beneficiated	Total	Percentage of beneficiated to total	Year	Beneficiated	Total	Percentage of beneficiated to total
1914	4, 130, 298	39, 714, 280	10. 4	1923	10, 686, 992	69, 811, 472	15. 3
1915	5, 581, 029	55, 493, 100	10. 1	1924	7, 092, 539	52, 083, 375	13. 6
1916	8, 105, 011	77, 870, 553	10. 4	1925	8, 735, 672	63, 924, 763	13. 7
1917	8, 166, 564	75, 573, 207	10. 8	1926	8, 371, 829	69, 292, 832	12. 1
1918	7, 881, 570	72, 021, 202	10. 9	1927	8, 114, 673	61, 232, 473	13. 3
1919	7, 355, 934	56, 372, 784	13. 0	1928	8, 621, 331	63, 432, 826	13. 6
1920	8, 514, 838	69, 281, 341	12. 3	1929	[1] 9, 424, 445	75, 602, 734	[1] 12. 5
1921	3, 727, 621	26, 652, 528	14. 0	1930	8, 863, 344	55, 201, 221	16. 1
1922	6, 623, 144	50, 612, 620	13. 1				

[1] Revised figures.

Minnesota contributed 65 per cent of the total shipments of beneficiated ore during the period 1914 to 1930. The proportion of beneficiated to total iron ore shipped from Minnesota increased from 9.1 per cent in 1914 to 17 per cent in 1923 and remained practically stationary in 1924 and 1925. The proportion declined sharply to 14 per cent in 1929. In 1930, however, new washing plants to treat ores from the Holman-Brown, Bingham-North Star, Drew, and Malta mines and a new sintering plant to treat ore from the Bruce mine were put in operation; the capacity of the sintering plant at the Evergreen mine was increased 50 per cent; and an additional unit, doubling the capacity, was built at the Patrick mine. These additions resulted in an increase to 18.5 per cent in the proportion of beneficiated ore shipped from Minnesota.

A number of interesting papers on the beneficiation of iron ore have been published during 1930. The washing of Mesabi range iron ores has been described by Mahon and Counselman,[17] the Rheolaveur method of ore beneficiation has been described by Walle,[18] the sintering of soft iron ores has been described by Harrison,[19] and the beneficiation of iron ores from the blast-furnace viewpoint has been discussed by Sweetser.[20]

IRON AND STEEL

The records of the production and sales of iron and steel shown in the following pages are derived in part from data supplied by producers who report direct to the Bureau of Mines and in part from several other authoritative sources, such as the American Iron and Steel Institute, Metal Statistics, the Iron Age, and the Iron Trade Review. The statistics on imports and exports are from the Bureau of Foreign and Domestic Commerce.

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[17] Mahon, S. A., and Counselman, T. B., Developments in Washing Mesabi Iron Ores: Proc. 28th Ann. Meeting Lake Superior Mining Inst., vol. 28, 1930, pp. 39–50.

[18] Walle, M. P., The Rheolaveur Method of Ore Beneficiation: Proc. 28th Ann. Meeting Lake Superior Mining Inst., vol. 28, 1930, pp. 51–61.

[19] Harrison, P. G., The Adaptation of the Sintering Process to Soft Iron Ores, i. e., Evergreen Mining Co. Sintering Experience: Proc. 28th Ann. Meeting Lake Superior Mining Inst., vol. 28, 1930, pp. 67–73.

[20] Sweetser, R. H., Beneficiation of Iron Ores from the Blast-Furnace Viewpoint: Proc. 28th Ann. Meeting Lake Superior Mining Inst., vol. 28, 1930, pp. 74–84.

PIG IRON

SHIPMENTS, VALUE, AND PRODUCTION, BY STATES

The shipments of pig iron, exclusive of ferro-alloys, reported by the manufacturers to the Bureau of Mines amounted to 29,905,355 gross tons, valued at $512,165,131, in 1930, a decrease of 28 per cent in quantity and 30 per cent in total value as compared with 1929. The values given represent the approximate amounts received for the iron f. o. b. furnaces and do not include freight costs, selling commissions, and other items that are figured in some of the market prices of pig iron as published in trade journals.

The pig iron shipped includes metal produced from foreign as well as from domestic ore. Although the pig iron made from ore imported from Africa, Asia (Palestine), Australia, Brazil, Canada, Chile, Cuba, Greece, Newfoundland, Russia, Spain, and Sweden constitutes a very small percentage of the total production, it amounted in 1930 to 1,216,406 gross tons, valued at $21,314,142, as compared with 1,666,328 tons, valued at $30,245,009, from foreign ore in 1929. In the manufacture during 1930 of 1,288,665 gross tons of pig iron, 2,190,783 gross tons of foreign ore was reported to have been used, indicating an average pig-iron yield of 58.82 per cent from imported ore. Domestic ore and 4,918,940 gross tons of cinder, scale, and scrap, amounting in all to 58,003,901 tons, were reported used in making 29,748,201 tons of pig iron, indicating an average pig-iron yield of 51.29 per cent from domestic materials. The total production of pig iron, exclusive of ferro-alloys, reported to the Bureau of Mines, was 31,036,866 gross tons, compared with 41,761,488 gross tons in 1929, a decrease of 26 per cent.

Pig iron shipped from blast furnaces in the United States, 1929 and 1930, by States

State	1929		1930	
	Gross tons	Value	Gross tons	Value
Alabama	2,697,814	$43,674,910	2,294,513	$31,083,905
Colorado	(1)	(1)	(1)	(1)
Illinois	4,316,096	79,672,295	3,050,743	54,290,144
Indiana	4,279,825	71,416,732	3,195,517	52,869,137
Kentucky	194,150	(1)	85,328	(1)
Maryland	1,111,219	(1)	981,466	(1)
Massachusetts	(1)	(1)	(1)	(1)
Michigan	841,089	14,099,647	711,224	12,859,820
Minnesota	376,551	(1)	266,622	(1)
New Jersey	204	(1)	405	(1)
New York	2,626,771	46,960,186	1,638,323	29,160,894
Ohio	9,446,984	163,480,003	6,541,212	111,529,209
Pennsylvania	14,058,194	257,154,601	9,734,591	176,521,843
Tennessee	104,985	1,938,238	42,197	828,716
Utah	(1)	(1)	(1)	(1)
Virginia	44,512	(1)	50,629	(1)
West Virginia	653,048	(1)	704,654	(1)
Undistributed	[2] 797.719	[2] 53,461,463	[2] 607,931	[2] 43,021,463
	41,549,161	731,858,075	29,905,355	512,165,131

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[1] Included under "Undistributed."

[2] Includes figures for States entered as "(1)" above.

Pig iron shipped from blast furnaces in the United States, 1929 and 1930, by grades

Grade	1929			1930		
	Gross tons	Value		Gross tons	Value	
		Total	Average		Total	Average
Charcoal	152,482	$3,487,397	$22.87	81,422	$1,845,545	$22.67
Foundry	4,441,016	76,447,166	17.21	3,139,257	50,484,699	16.08
Basic	24,448,163	420,843,248	17.21	18,601,260	311,508,654	16.75
Bessemer	9,836,120	179,191,434	18.22	6,496,164	118,313,691	18.21
Low-phosphorus	358,258	8,065,880	22.51	213,532	4,805,176	22.50
Malleable	2,130,593	39,815,782	18.69	1,269,989	22,949,526	18.07
Forge	100,246	1,820,750	18.16	58,901	1,034,695	17.57
All other (not ferro-alloys)	82,283	2,188,428	26.60	44,830	1,223,745	27.30
	41,549,161	731,858,075	17.61	29,905,355	512,165,131	17.13

Pig iron shipped from blast furnaces in the United States, 1910–1930

Year	Gross tons	Value	Year	Gross tons	Value
1910	26,674,123	$412,162,486	1921	16,038,619	$389,437,792
1911	23,257,288	327,334,624	1922	27,670,738	608,144,858
1912	30,180,969	420,563,388	1923	38,361,379	946,799,378
1913	30,588,935	458,342,345	1924	31,064,129	665,078,972
1914	22,263,263	298,777,429	1925	36,814,702	789,316,333
1915	30,384,486	401,409,604	1926	38,181,053	749,633,468
1916	39,126,324	663,478,118	1927	34,866,644	646,226,139
1917	38,612,546	1,053,785,975	1928	38,305,699	661,351,270
1918	38,230,440	1,180,759,565	1929	41,549,161	731,858,075
1919	30,130,231	775,915,043	1930	29,905,355	512,165,131
1920	35,710,227	1,140,904,096			

The American Iron and Steel Institute reports that in 1930 the output of all kinds of pig iron and ferro-alloys was 31,752,169 gross tons, a decrease of 25 per cent as compared with 1929.

Pig iron (including ferro-alloys) manufactured in the United States, 1929 and 1930, in gross tons[1]

State	1929	1930	State	1929	1930
Pennsylvania	14,453,251	10,304,886	Tennessee	138,753	864,824
Ohio	9,795,648	6,804,862	West Virginia	864,201	
Illinois	4,357,071	3,344,674	Kentucky		
Alabama	2,700,881	2,394,725	Iowa	638,015	804,686
Indiana	5,085,615	3,934,212	Colorado		
Michigan			Utah		
New York	3,025,282	2,211,434	Minnesota	379,162	
Massachusetts					
Maryland	1,166,204	1,087,866		42,613,983	31,752,169
Virginia					

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[1] American Iron and Steel Institute.

AVERAGE VALUES

Values at blast furnaces.—The average value of all kinds of pig iron given in the accompanying table is based on the reports of the manufacturers to the Bureau of Mines. The figures represent the approximate values f. o. b. at the blast furnaces and do not include the values of ferro-alloys. The general average value for all grades of pig iron at the furnaces, exclusive of ferro-alloys, was $17.13 a gross ton in 1930, a decrease of 3 per cent from 1929.

Average value per gross ton of pig iron at blast furnaces in the United States, 1926–1930

State	1926	1927	1928	1929	1930
Alabama	$20.21	$18.55	$16.71	$16.19	$13.55
Illinois	20.26	19.17	17.96	18.46	17.80
Indiana	18.88	18.01	16.56	16.69	16.54
Michigan	20.65	20.00	19.00	16.76	18.08
New York	18.82	16.99	16.85	17.88	17.80
Ohio	19.23	18.34	16.93	17.30	17.05
Pennsylvania	20.03	19.04	17.61	18.29	18.13
Tennessee	22.51	21.73	18.70	18.46	19.64
Virginia	22.11	20.99	19.72	(1)	(1)
Wisconsin	21.37	(1)	(1)		
Other States [2]	18.59	17.73	17.10	16.83	15.85
Average for United States	19.63	18.53	17.27	17.61	17.13

[1] Included under "Other States."

[2] 1926: Colorado, Kentucky, Maryland, Massachusetts, Minnesota, New Jersey, Utah, and West Virginia; 1927–28: Colorado, Kentucky, Maryland, Massachusetts, Minnesota, Utah, West Virginia, and Wisconsin; 1929–30: Colorado, Kentucky, Maryland, Massachusetts, Minnesota, New Jersey, Utah, Virginia, and West Virginia.

Average value per gross ton of pig iron at blast furnaces in the United States, 1889–1930

1889	$15.78	1903	$19.12	1917	$27.29
1890	16.43	1904	14.13	1918	30.89
1891	15.50	1905	16.63	1919	25.75
1892	14.32	1906	19.98	1920	31.95
1893	11.90	1907	20.56	1921	24.28
1894	9.76	1908	15.96	1922	21.98
1895	11.14	1909	16.25	1923	24.68
1896	10.47	1910	15.45	1924	21.41
1897	9.85	1911	14.07	1925	20.08
1898	9.90	1912	13.93	1926	19.63
1899	18.00	1913	15.08	1927	18.53
1900	18.85	1914	13.42	1928	17.27
1901	15.25	1915	13.21	1929	17.61
1902	20.92	1916	16.96	1930	17.13

Commercial quotations.—The average monthly prices, according to published market quotations, of foundry, basic, and Bessemer pig iron at Valley furnaces and of foundry pig iron at Birmingham furnaces are summarized in the following table.

Average monthly prices per ton of chief grades of pig iron, 1929 and 1930 [1]

Month	Foundry pig iron at Valley furnaces		Foundry pig iron at Birmingham furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1929	1930	1929	1930	1929	1930	1929	1930
January	$17.50	$18.50	$16.50	$15.00	$18.00	$19.00	$17.50	$18.50
February	17.50	18.50	16.50	14.71	18.00	19.00	17.50	18.50
March	17.69	18.50	16.08	14.38	18.19	19.00	17.62	18.50
April	18.00	18.50	15.50	14.00	18.50	19.00	18.00	18.50
May	18.31	18.50	15.00	14.00	18.81	19.00	18.31	18.50
June	18.50	18.50	15.00	14.00	19.00	19.00	18.50	18.50
July	18.50	18.12	14.62	14.00	19.00	18.62	18.50	18.12
August	18.50	18.00	14.50	14.00	19.00	18.50	18.50	18.00
September	18.50	17.88	14.50	14.00	19.00	18.38	18.50	17.76
October	18.50	17.22	14.50	14.00	19.00	17.85	18.50	17.00
November	18.50	17.00	14.50	14.00	19.00	17.50	18.50	17.00
December	18.50	17.00	14.50	14.00	19.00	17.50	18.50	17.00
Average	18.21	18.02	15.14	14.17	18.71	18.53	18.20	17.99

[1] Metal Statistics, 1931.

PRODUCTION BY GRADES AND BY FUEL USED, TOTAL PRODUCTION, AND BLAST FURNACES

The statistics of production of pig iron by grades and by fuel used for 1926 to 1930, the total output of pig iron, and the number of furnaces in blast in 1929 and 1930 have been published by the American Iron and Steel Institute, as shown in the tables that follow. These figures include ferro-alloys. Metals produced by the use of electricity and by the use of coke and electricity together are included in coke pig iron.

Pig iron (including ferro-alloys) manufactured in the United States, 1926–1930, by grades, in gross tons

Grade	1926	1927	1928	1929	1930
Bessemer and low-phosphorus	10, 042, 324	9, 105, 915	9, 013, 847	9, 877, 240	7, 314, 749
Basic	21, 168, 407	19, 357, 064	22, 124, 410	24, 911, 654	18, 393, 384
Forge	216, 277	144, 532	88, 362	167, 930	50, 696
Foundry	5, 506, 968	5, 504, 419	4, 209, 790	4, 446, 011	3, 622, 779
Malleable	1, 681, 897	1, 699, 583	1, 922, 970	2, 312, 813	1, 571, 512
Ferrosilicon	245, 605	278, 277	303, 595	341, 222	337, 640
Spiegeleisen	76, 215	100, 720	419, 213	476, 655	362, 386
Ferromanganese	318, 891	293, 626			
White, mottled, direct castings, and other ferro-alloys	116, 145	81, 509	73, 527	80, 458	99, 023
	39, 372, 729	36, 565, 645	38, 155, 714	42, 613, 983	31, 752, 169

Pig iron (including ferro-alloys) manufactured in the United States, 1926–1930, by fuel used, in gross tons

Fuel used	1926	1927	1928	1929	1930
Bituminous, chiefly coke	39, 208, 849	36, 398, 791	38, 012, 754	42, 475, 790	31, 655, 589
Charcoal	163, 880	166, 854	142, 960	138, 193	96, 580
	39, 372, 729	36, 565, 645	38, 155, 714	42, 613, 983	31, 752, 169

The next table shows the production in the United States of pig iron, including ferro-alloys, so far as it has been recorded.

Pig iron (including ferro-alloys) manufactured in the United States, 1810–1930, in gross tons

1810–1860	10, 542, 548	1924	31, 405, 790
1861–1870	11, 366, 963	1925	36, 700, 566
1871–1880	24, 055, 278	1926	39, 372, 729
1881–1890	56, 902, 041	1927	36, 565, 645
1891–1900	98, 124, 754	1928	38, 155, 714
1901–1910	211, 321, 934	1929	42, 613, 983
1911–1920	322, 643, 101	1930	31, 752, 169
1921	16, 688, 126		
1922	27, 219, 904		1, 075, 792, 391
1923	40, 361, 146		

The number of furnaces in blast on June 30 and December 31 and the total number of stacks recorded for 1929 and 1930, exclusive of electric reduction furnaces, were as follows:

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1929 and 1930

State	In blast June 30, 1929	Dec. 31, 1929			In blast June 30, 1930	Dec. 31, 1930		
		In	Out	Total		In	Out	Total
Alabama	17	15	12	27	14	8	17	25
Colorado	2	3	2	5	2	2	3	5
Illinois	19	16	9	25	15	10	15	25
Indiana	16	11	7	18	11	7	11	18
Kentucky	2	2	--------	2	1	1	1	2
Maryland	6	4	2	6	4	2	4	6
Massachusetts	1	1	--------	1	1	1	--------	1
Michigan	8	7	3	10	7	5	4	9
Minnesota	3	2	1	3	2	1	2	3
Mississippi	--------	--------	1	1	--------	--------	1	1
Missouri	--------	--------	2	2	--------	--------	2	2
New Jersey	--------	--------	2	2	--------	--------	2	2
New York	16	11	10	21	12	5	16	21
Ohio	47	32	27	59	36	16	42	58
Pennsylvania	79	53	54	107	53	31	73	104
Tennessee	4	2	7	9	1	2	4	6
Texas	--------	--------	1	1	--------	--------	--------	--------
Utah	1	1	--------	1	1	1	--------	1
Virginia	1	2	8	10	1	2	6	8
West Virginia	3	3	1	4	3	3	--------	3
Wisconsin	--------	--------	2	2	--------	--------	--------	--------
	225	165	151	316	164	97	203	300

FOREIGN TRADE IN PIG IRON

Imports of pig iron into the United States in 1930 were 137,031 gross tons, valued at $1,806,754, a decrease of 7 per cent in quantity and 25 per cent in total value as compared with 1929. India was again the chief source of imported pig iron in 1930, supplying 79 per cent of the total; the United Kingdom and the Netherlands were again the other important sources, supplying 10 and 5 per cent, respectively, of the total.

Pig iron imported into the United States, 1926–1930, by countries, in gross tons

Country	1926	1927	1928	1929	1930
North America:					
Canada	4,767	725	1,015	7,382	664
Mexico	70	97	423	387	41
Europe:					
Belgium	7,488	699	272	284	669
France	28,449	3,000	30	101	------------
Germany	157,094	9,211	695	103	50
Netherlands	69,054	29,380	26,989	24,189	6,243
Norway	2	------------	1,186	3,400	2,610
Sweden	3,455	1,700	2,720	3,534	4,092
United Kingdom	92,083	21,129	50,944	39,140	14,239
Asia:					
India, British	83,311	66,627	56,420	69,243	108,261
Japan	------------	------------	------------	------------	102
Kwantung	------------	------------	------------	------------	60
	445,773	132,568	140,694	147,763	137,031
Value	$7,708,982	$2,254,355	$2,232,094	$2,398,488	$1,806,754

Pig iron [1] imported into the United States, 1921–1930

Year	Gross tons	Value	Year	Gross tons	Value
1921 [1]	44,036	$2,014,926	1926	445,773	$7,708,982
1922	383,445	8,670,860	1927	132,568	2,254,355
1923	367,778	9,005,077	1928	140,694	2,232,094
1924	209,109	3,741,213	1929	147,763	2,398,488
1925	441,425	7,951,283	1930	137,031	1,806,754

[1] Figures for 1921 include ferro-alloys. Separate data not available prior to 1922.

Exports of pig iron from the United States in 1930 were 13,671 gross tons, valued at $291,683, a decrease of 71 per cent in quantity and 65 per cent in total value as compared with 1929. The average value of the pig iron exported was $21.34 a ton in 1930, as compared with $17.91 a ton in 1929. Canada was again the best customer in 1930, taking 71 per cent of the total.

Pig iron exported from the United States, 1929 and 1930, by countries, in gross tons

Country	1929	1930	Country	1929	1930
North America:			Europe—Continued.		
Canada	23,431	9,767	Italy	90	
Cuba	261	304	United Kingdom	209	71
Mexico	143	106	Other countries	5	
Panama	392	420	Asia:		
Other countries	115	34	China	50	71
South America:			Japan	16,930	496
Chile	848	201	Philippine Islands	880	254
Colombia	69	122	Oceania:		
Peru	711		Australia		12
Other countries	190	26	New Zealand	14	
Europe:					
Belgium	590	722		46,357	13,671
France	898	705	Value	$830,225	$291,683
Germany	531	360			

Pig iron [1] exported from the United States, 1921–1930

Year	Gross tons	Value	Year	Gross tons	Value
1921 [1]	28,307	$933,093	1926	25,208	$523,883
1922	30,920	756,842	1927	50,992	1,028,425
1923	32,318	862,443	1928	84,682	1,366,794
1924	41,483	957,921	1929	46,357	830,225
1925	32,674	724,565	1930	13,671	291,683

[1] Figures for 1921 include ferro-alloys. Separate data not available prior to 1922.

WORLD PRODUCTION OF PIG IRON, BY COUNTRIES

The accompanying table shows the predominance of the United States in the manufacture of pig iron and, with the table giving exports from the United States, indicates that the consumption in the principal European countries is still comparatively small.

Pig iron (including ferro-alloys) produced, 1926–1930, by countries, in metric tons

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
Australia	445,739	525,525	417,468	337,975	[1] 350,000
Austria	331,635	432,749	458,451	458,973	296,824
Belgium	3,368,347	3,709,090	3,856,990	4,040,530	3,403,010
Brazil [2]	70,000	70,000	70,000	70,000	70,000
Canada	827,438	778,220	1,099,578	1,189,037	827,006
China	400,000	411,148	[1] 300,000	[1] 300,000	[1] 300,000
Chosen	118,102	129,022	148,652	155,514	151,378
Czechoslovakia	1,087,984	1,260,363	1,569,264	1,644,515	1,437,089
Finland	8,871	11,860	8,470	6,608	3,444
France	9,430,025	9,294,620	10,072,100	10,362,000	10,280,000
Germany (exclusive of the Saar)	9,636,054	13,088,798	11,803,565	13,239,455	9,694,509
Saar	1,638,051	1,770,718	1,936,184	2,104,940	1,912,444
Great Britain	2,497,654	7,409,951	6,717,400	7,701,200	6,296,259
Hungary	189,208	300,237	285,461	367,951	257,226
India, British	927,589	1,163,523	1,072,052	1,417,563	[1] 1,400,000
Italy	558,509	529,489	548,828	726,544	587,594
Japan [3]	821,326	911,261	1,540,465	1,514,800	[1] 1,500,000
Luxemburg	2,559,151	2,732,000	2,770,066	2,906,093	2,473,714
Mexico	61,796	40,415	49,442	[1] 50,000	[1] 50,000
Netherlands	142,504	203,692	258,224	253,776	272,718
New Zealand	4,061	3,437	6,464	4,464	8,205
Norway	97,311	110,416	123,583	144,419	[1] 140,000
Philippine Islands	306	200	209	166	[1] 200
Poland	327,471	618,209	683,951	704,433	477,949
Rumania	62,979	63,498	70,123	72,346	[1] 70,000
Russia [4]	2,217,933	2,953,514	3,281,977	4,018,700	4,982,200
Spain	488,696	593,070	562,821	752,618	621,891
Sweden	494,663	454,518	437,512	523,829	456,800
Union of South Africa	20,382	30,610	9,057	16,510	29,726
United States	40,004,661	37,152,524	38,768,113	43,297,937	32,261,791
Yugoslavia	18,768	22,651	29,303	30,885	35,011
	78,857,000	86,775,000	88,956,000	98,414,000	80,647,000

[1] Approximate production.
[2] Official estimate of annual production.
[3] Includes pig iron produced at Government and other steelworks for conversion into steel.
[4] Year ended Sept. 30.

FERRO-ALLOYS

PRODUCTION, SHIPMENTS, VALUE, AND PRICES

In these reports the statistics on the output of ferro-alloys are separated from those of pig iron in order that the values given may be more nearly accurate. Although the quantity of ferro-alloys is relatively small, the values per ton are so high that failure to separate the figures would unduly increase the apparent average value of the pig iron.

The shipments of ferro-alloys of all classes in 1930 were 650,240 gross tons, valued at $51,900,220, a decrease of 22 per cent in quantity and 31 per cent in total value as compared with 1929.

The production of ferro-alloys was 732,518 gross tons in 1930, compared with 869,563 tons in 1929, a decrease of 16 per cent. Ferro-alloys were made in 1930 at 12 blast furnaces, 13 electric furnaces, and 2 alumino-thermic plants; in addition, 2 plants made ferrosilicon and 2 plants made ferrophosphorus as a by-product.

Ferro-alloys shipped from furnaces in the United States, 1929 and 1930, by varieties

Variety of alloy	1929		1930	
	Gross tons	Value	Gross tons	Value
Ferromanganese	334, 162	$33, 184, 012	273, 640	$25, 865, 783
Spiegeleisen	123, 146	3, 336, 703	94, 918	2, 469, 861
Ferrosilicon (7 per cent or more silicon)	310, 280	15, 730, 950	234, 328	10, 430, 720
Ferrotungsten	3, 049	5, 828, 760	736	1, 603, 903
Ferrovanadium	1, 767	4, 665, 720	831	2, 244, 304
Other varieties [1]	56, 920	12, 759, 933	45, 787	9, 285, 649
	829, 324	75, 506, 078	650, 240	51, 900, 220

[1] Ferrochromium, ferromolybdenum and calcium-molybdenum compounds, ferrophosphorus, ferrotitanium, ferrozirconium, silicomanganese and silicospiegeleisen, and zirconium-ferrosilicon.

Ferro-alloys shipped from furnaces in the United States, 1921–1930, in gross tons

Year	Ferromanganese	Spiegeleisen	Other varieties	Total	
				Quantity	Value
1921	111, 374	69, 230	68, 023	248, 627	$21, 697, 785
1922	161, 612	70, 253	191, 415	423, 280	28, 259, 004
1923	226, 365	134, 086	219, 366	579, 817	49, 877, 231
1924	232, 821	76, 179	188, 244	497, 244	43, 249, 948
1925	254, 005	95, 890	266, 327	616, 222	53, 048, 109
1926	330, 070	82, 982	276, 206	689, 258	61, 368, 407
1927	291, 056	80, 892	274, 801	646, 749	55, 163, 574
1928	310, 122	116, 911	367, 662	794, 695	66, 578, 039
1929	334, 162	123, 146	372, 016	829, 324	75, 506, 078
1930	273, 640	94, 918	281, 682	650, 240	51, 900, 220

The following records of average contract prices of ferromanganese and of spiegeleisen, by months, for the last four years, show considerable fluctuation. The ferromanganese prices are quoted for material "delivered at Pittsburgh"; those for spiegeleisen are prices at producers' furnaces.

Quoted prices per ton of ferromanganese and spiegeleisen, 1927–1930 [1]

Month	Ferromanganese (delivered at Pittsburgh)				Spiegeleisen (at producers' furnaces)			
	1927	1928	1929	1930	1927	1928	1929	1930
January	$104. 79	$104. 79	$109. 79	$104. 79	$37. 00	$32. 00	$34. 00	$34. 00
February	104. 79	104. 79	109. 79	103. 79	37. 00	32. 00	34. 00	34. 00
March	104. 79	104. 79	109. 79	103. 79	37. 00	32. 00	34. 00	34. 00
April	104. 79	104. 79	109. 79	103. 79	37. 00	32. 00	34. 00	34. 00
May	98. 54	108. 19	109. 79	103. 79	35. 50	32. 00	34. 00	34. 00
June	94. 79	109. 79	109. 79	103. 79	34. 80	32. 00	34. 00	34. 00
July	94. 79	109. 79	109. 79	103. 79	34. 00	33. 00	34. 00	33. 00
August	94. 79	109. 79	109. 79	103. 79	33. 35	33. 00	33. 20	33. 00
September	94. 79	109. 79	109. 79	103. 79	33. 00	33. 00	33. 50	33. 00
October	94. 79	109. 79	109. 79	103. 79	30. 15	33. 00	34. 00	33. 00
November	94. 79	109. 79	109. 79	103. 79	30. 00	33. 00	34. 00	33. 00
December	103. 42	109. 79	104. 79	89. 79	31. 00	34. 00	34. 00	30. 00

[1] Steel: Vol. 88, Jan. 1, 1931.

Ferromanganese.—The shipments of ferromanganese in 1930 amounted to 273,640 gross tons, a decrease of 18 per cent from 1929. The average value per ton f. o. b. furnaces reported for ferromanganese was $94.52 in 1930, compared with $99.31 in 1929. Ferromanganese was made at 8 furnaces by 6 producers in both 1930 and 1929.

The production of ferromanganese in 1930 was 274,830 gross tons, containing about 216,000 tons of manganese (metal), an average of 78.59 per cent of manganese. In the production of ferromanganese in 1930 there were used 459,478 gross tons of foreign manganese ore, 40,501 tons of foreign ferruginous manganese ore, 32,969 tons of domestic manganese ore, 10,538 tons of iron ore, and 9,712 tons of cinder, scale, and scrap. The quantity of manganese ore used per ton of ferromanganese made was 1.792 tons in 1930, 1.894 tons in 1929, and 1.891 tons in 1928. Of the foreign manganese ore used in 1930, Russia supplied 211,436 gross tons; Brazil, 138,757 tons; Africa, 62,913 tons; India, 44,667 tons; and Chile, 1,705 tons. The quantity of domestic manganese ore used in the manufacture of ferromanganese in 1930 represented 6.7 per cent of the total manganese ore used, as compared with 4.3 per cent in 1929.

Manganese ore and other metallic materials consumed and ferromanganese produced in the United States, 1921–1930

Year	Materials consumed (gross tons)				Ferromanganese produced			Manganese ore used per ton of ferromanganese made (gross tons)
	Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and scrap	Gross tons	Manganese contained		
	Foreign	Domestic				Per cent	Gross tons	
1921	208, 376	17, 839	143	2, 092	104, 129	76. 17	79, 319	2. 172
1922	335, 165	1, 804	----------	5, 252	150, 010	78. 55	117, 836	2. 246
1923	538, 280	26, 790	498	6, 945	251, 938	78. 13	196, 844	2. 243
1924	443, 260	20, 133	909	4, 434	211, 965	78. 21	165, 776	2. 186
1925	519, 139	34, 942	4, 949	11, 072	259, 780	78. 93	205, 046	2. 133
1926	619, 898	36, 309	8, 064	5, 122	318, 052	79. 25	252, 066	2. 063
1927	564, 725	25, 298	12, 735	8, 570	294, 991	78. 95	232, 900	2. 000
1928	566, 859	37, 827	23, 159	8, 395	319, 770	78. 62	251, 400	1. 891
1929	614, 763	27, 558	47, 735	7, 811	339, 205	79. 30	269, 000	1. 894
1930	459, 478	32, 969	51, 039	9, 712	274, 830	78. 59	216, 000	1. 792

Manganese ore used in the manufacture of ferromanganese in the United States, 1929 and 1930, by sources of ore, in gross tons

Source of ore	1929	1930
Africa	28, 592	62, 913
Brazil	228, 737	138, 757
Chile	1, 187	1, 705
Cuba	2, 050	----------
India	86, 547	44, 667
Russia	267, 600	211, 436
Turkey	50	----------
	614, 763	459, 478
United States	27, 558	32, 969
	642, 321	492, 447

Spiegeleisen.—The shipments of spiegeleisen in 1930 amounted to 94,918 gross tons, or 23 per cent less than in 1929. The average value per ton at the furnaces in 1930 was $26.02; in 1929 it was $27.10. Spiegeleisen was made at 5 furnaces by 3 producers in 1930 and at 5 furnaces by 4 producers in 1929.

The production of spiegeleisen in 1930 was 87,059 gross tons, containing 17,412 tons of manganese (metal), an average of 20 per cent.

Ferrosilicon.—The production of ferrosilicon in 1930 amounted to 315,684 gross tons, compared with 325,034 tons in 1929, a decrease of 3 per cent. Of the ferrosilicon produced in 1930, 51.27 per cent was made by the blast-furnace process, 48.6 per cent by the electric-furnace process, and 0.13 per cent as a by-product of the manufacture of artificial abrasives in electric furnaces. The shipments of ferrosilicon in 1930 amounted to 234,328 gross tons, as compared with 310,280 tons in 1929.

Ferrotungsten.—The production of ferrotungsten in 1930 was 907 gross tons, containing 1,592,294 pounds of tungsten (metal), an average of 78.39 per cent of tungsten. Ferrotungsten was made at 3 furnaces by 3 producers in both 1930 and 1929. The greater part of the ferrotungsten produced in 1930 was made from foreign ores, chiefly from China and Burma. The domestic ores used came mostly from California, Colorado, and Nevada.

The shipments of ferrotungsten in 1930, amounting to 736 gross tons, contained 1,282,620 pounds of tungsten, and the average value per pound of contained tungsten was $1.25 f. o. b. furnaces, compared with $1.10 in 1929.

Ferrovanadium.—The production of ferrovanadium in 1930 amounted to 1,257 gross tons, containing 1,079,849 pounds of vanadium (metal), an average of 38.35 per cent of vanadium. Ferrovanadium was made at 5 furnaces by 4 producers in 1930 and at 4 furnaces by 3 producers in 1929. The ferrovanadium produced in 1930 was made chiefly from patronite and its oxidation products from Peru, although vanadium pentoxide made from roscoelite mined in Colorado entered in appreciable amount into the output of ferrovanadium.

The shipments of ferrovanadium in 1930 were 831 gross tons, containing 713,480 pounds of vanadium, and were valued at the furnaces at an average of $3.15 per pound of contained vanadium, as compared with $3.12 in 1929.

IMPORTS AND EXPORTS

The imports of the alloys of the rarer metals are not all reported separately but are grouped as shown in the next table. Ferromanganese constituted the bulk of the imports in 1930; 42 per cent of it came from Canada, 34 per cent from the United Kingdom, and 19 per cent from Norway.

Prior to the tariff of September 22, 1922, the Bureau of Foreign and Domestic Commerce recorded only the gross weight of the ferro-alloys imported. Since that date the import statistics are not uniform, the gross weight of some ferro-alloys and the contained rarer metal of others being recorded. The reader should bear in mind this change when comparing the quantities in the two following tables with quantities published before the change in tariff. The values, however, are comparable.

The exports of ferro-alloys are relatively unimportant. Ferromanganese and spiegeleisen, the exports of which in 1930 were nearly four times those in 1929, constituted the greater part of the total exports in 1930.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1929 and 1930, by varieties

Variety of alloy	1929		1930	
	Gross tons	Value	Gross tons	Value
Ferromanganese (manganese content)	56, 969	$6, 126, 056	45, 001	$4, 128, 065
Spiegeleisen	13, 828	403, 853	13, 406	381, 197
Ferrochrome and chromium:				
Ferrochrome—				
Containing 3 per cent or more carbon (chromium content)	37	8, 835		
Containing less than 3 per cent carbon	638	206, 311	153	31, 428
Chrome or chromium metal	21	5, 242		
Ferrosilicon (silicon content)	9, 285	1, 388, 423	4, 541	623, 307
Molybdenum and ferromolybdenum (molybdenum content)	1	2, 384	65	283, 846
Titanium and ferrotitanium	7	2, 517	1	496
Tungsten and ferrotungsten (tungsten content)	211	376, 230	135	417, 906
Ferrovanadium	46	89, 229		
		8, 609, 080		5, 866, 245

Ferromanganese and ferrosilicon imported into the United States, 1929 and 1930, by countries

[General imports]

Country	Ferromanganese (manganese content)				Ferrosilicon (silicon content)			
	1929		1930		1929		1930	
	Gross tons	Value	Gross tons	Value	Gross tons	Value	Gross tons	Value
Canada	27, 474	$3, 593, 981	16, 216	$2, 016, 293	7, 772	$1, 193, 261	3, 998	$497, 033
France	516	73, 929	170	30, 320			10	1, 620
Germany	100	6, 713	324	24, 279	1	468	(1)	224
Italy	2, 096	330, 480	1, 023	159, 771			10	1, 523
Norway	18, 743	1, 702, 579	7, 458	789, 662	1, 651	208, 016	1, 076	130, 806
Sweden	71	8, 599						
Switzerland							94	11, 592
United Kingdom	13, 785	1, 100, 965	13, 261	971, 195			(1)	300
	62, 785	6, 817, 246	38, 452	3, 991, 520	9, 424	1, 401, 745	5, 188	643, 098

[1] Less than 1 ton.

Ferro-alloys and ferro-alloy metals exported from the United States, 1928–1930, by varieties

Variety of alloy	1928		1929		1930	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Ferromanganese [1] Spiegeleisen [1]	9, 440	$232, 990	1, 574	$59, 036	6, 189	$145, 629
Tungsten and ferrotungsten (including tungsten wire)	7	123, 354	46	325, 133	13	221, 934

[1] Not separately classified.

STEEL

PRODUCTION

The following tables showing the production of steel were compiled by the American Iron and Steel Institute. No data whatever are available on the value of the output of crude steel at the mills, but the weekly issues and annual statistical reviews of Iron Age give market quotations of prices of steel billets and some of the leading forms of finished steel. The price of both open-hearth and Bessemer steel billets at Pittsburgh in 1930 ranged from $30.60 to $34 a gross ton; in 1929 it ranged from $33 to $36 a ton. Both tank plates and structural shapes at Pittsburgh ranged from 1.6 to 1.83 cents a pound in 1930 and from 1.9 to 1.95 cents a pound in 1929. Automobile body sheets, base No. 22 gage, f. o. b. Pittsburgh, ranged from 3.3 to 3.9 cents a pound in 1930 and from 3.98 to 4.1 cents a pound in 1929.

Bessemer steel ingots and castings manufactured in the United States, 1926–1930, by States, in gross tons

State	1926	1927	1928	1929	1930
Ohio	3,035,809	2,440,235	2,577,728	2,724,864	1,892,021
Pennsylvania	2,420,719	2,108,483	2,293,085	2,427,490	1,732,545
Illinois	874,047	835,254	978,511	1,073,790	718,104
Other States	603,993	807,755	770,871	896,365	692,789
	6,934,568	6,191,727	6,620,195	7,122,509	5,035,459

Open-hearth steel ingots and castings manufactured in the United States, 1926–1930, by States, in gross tons

State	1926	1927	1928	1929	1930
New England States	288,533	256,716	285,767	325,232	214,425
New York and New Jersey	2,086,525	2,003,599	2,323,333	2,541,856	1,764,976
Pennsylvania	15,622,857	13,708,156	15,261,713	17,504,807	12,488,175
Ohio	8,628,247	8,266,708	10,179,096	10,241,579	7,152,526
Indiana	5,278,230	5,118,620	5,971,416	6,235,333	4,742,297
Illinois	2,871,688	2,741,472	3,239,669	3,607,810	2,514,799
Other States	5,915,899	5,973,064	6,852,962	7,896,271	6,171,974
	40,691,979	38,068,335	44,113,956	48,352,888	35,049,172

According to these tables there was a decrease of 29 per cent in the production of Bessemer steel and of 28 per cent in open-hearth steel in 1930 as compared with 1929; the total production of steel decreased 28 per cent also. Of the total output in 1930, 86.1 per cent was represented by open-hearth, 12.4 per cent by Bessemer, and 1.5 per cent by all other classes of steel.

Of the total output of open-hearth steel, 34,268,316 gross tons was made by the basic process and 780,856 tons by the acid process, compared with 47,232,419 tons of basic steel and 1,120,469 tons of acid steel in 1929.

The production of steel by the electric process in 1930 decreased 36 per cent as compared with 1929.

Steel electrically manufactured in the United States, 1909–1930, in gross tons

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1909	13,456	306	13,762	1920	346,956	155,196	502,152
1910	50,821	1,320	52,141	1921	84,404	85,095	169,499
1911	27,227	1,878	29,105	1922	191,057	154,982	346,039
1912	14,147	4,162	18,309	1923	279,914	235,958	515,872
1913	20,973	9,207	30,180	1924	225,977	206,549	432,526
1914	15,458	8,551	24,009	1925	335,978	279,534	615,512
1915	46,348	23,064	69,412	1926	325,278	326,445	651,723
1916	126,048	42,870	168,918	1927	371,278	294,809	666,087
1917	239,632	64,911	304,543	1928	453,692	348,568	802,260
1918	403,068	108,296	511,364	1929	532,392	419,039	951,431
1919	272,942	111,510	384,452	1930	307,418	305,181	612,599

Figures for the total production of electric steel in 1930 include 300,520 tons of alloy-steel ingots and castings that were alloyed with nickel, vanadium, tungsten, chromium, molybdenum, and other metals (239,280 tons of ingots and 61,240 tons of castings), compared with 510,030 tons (415,963 tons of ingots and 94,067 tons of castings) so alloyed in 1929.

On December 31, 1930, the number of completed plants equipped for the manufacture of steel by the electric process was 245, as compared with 233 plants at the end of 1929.

Steel produced in the United States, 1810–1930, in gross tons

Year	Bessemer	Open-hearth	Crucible	Other steel	Total
1810–1870	58,482	2,232	146,370		207,084
1871	40,179	1,785	31,250		73,214
1872–1880	4,293,896	245,035	349,730	76,009	4,964,670
1881–1890	21,596,699	2,387,925	703,489	37,044	24,725,157
1891–1900	49,387,341	15,392,764	762,446	35,820	65,578,371
1901–1910	94,048,698	92,418,814	1,051,379	154,683	187,673,574
1911–1920	89,399,404	258,477,390	1,051,404	2,065,036	350,993,234
1921	4,015,938	15,589,802	7,613	170,444	19,783,797
1922	5,919,298	29,308,983	28,606	346,039	35,602,926
1923	8,484,088	35,899,657	44,079	515,872	44,943,696
1924	5,899,590	31,577,350	22,473	432,526	37,931,939
1925	6,723,962	38,034,488	19,562	615,512	45,393,524
1926	6,934,568	40,691,979	15,493	651,723	48,293,763
1927	6,191,727	38,068,335	9,036	666,087	44,935,185
1928	6,620,195	44,113,956	7,769	802,260	51,544,180
1929	7,122,509	48,352,888	6,645	951,431	56,433,473
1930	5,035,459	35,049,172	2,253	612,599	40,699,483

FOREIGN TRADE IN STEEL

The following tables show the imports and exports of certain iron and steel products.

Iron and steel imported into the United States, 1928–1930

Article	1928		1929		1930	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Bar iron	2,443	$158,014	2,930	$197,762	1,376	$101,624
Boiler and other plate of iron and steel	8,025	251,930	3,243	115,836	1,892	59,837
Iron and steel scrap	63,314	1,006,044	90,479	1,466,525	27,482	395,161
Rails for railways	14,019	432,452	6,236	184,921	8,307	240,331
Sheets of iron or steel, skelp, saw plates and steel, n. e. s	22,775	1,012,477	25,218	1,222,151	26,594	1,247,891
Steel ingots, bars, etc	21,439	908,538	26,493	1,109,061	22,313	749,010
Tin and terne plates	922	152,608	286	71,824	261	67,102
Wire and articles made from wire		4,314,378		4,400,592		2,850,389
Wire rods	19,298	1,122,409	15,653	1,045,334	8,843	585,191
All other manufactures of iron and steel (not specially provided for)		3,826,165		3,914,562		2,216,581

Iron and steel exported from the United States, 1929 and 1930

Article	1929		1930	
	Gross tons	Value	Gross tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	42,578	$1,499,644	17,032	$733,005
Iron and steel bars and rods—				
Iron bars	5,072	332,237	1,822	150,307
Steel bars	183,895	10,170,297	81,089	4,689,186
Alloy-steel bars	15,744	1,600,422	6,667	910,623
Wire rods	42,250	2,012,021	39,779	1,876,163
Iron and steel plates, sheets, skelp, and strips—				
Boiler plates	14,045	642,571	7,013	331,652
Other plates, not fabricated	179,651	9,374,994	91,325	4,526,620
Skelp iron or steel	130,977	5,507,393	119,887	5,193,246
Iron or steel sheets, galvanized	151,513	14,759,021	93,485	8,798,144
Steel sheets, black	173,601	14,307,338	137,919	10,342,884
Iron sheets, black	15,856	1,597,042	11,482	1,097,357
Strip steel, cold rolled	17,477	1,577,426	10,487	980,434
Hoop, band, and scroll iron or steel	53,386	3,558,337	28,828	1,712,806
Tin plate, terneplate, and taggers tin	258,965	28,566,189	216,517	24,201,977
Manufactures—steel-mill products:				
Structural iron and steel—				
Structural shapes—				
Not fabricated	288,513	12,683,746	140,415	6,234,346
Fabricated	57,484	5,170,345	57,607	5,525,213
Ship and tank plates, punched or shaped	6,232	486,715	5,629	316,687
Metal lath	5,455	815,533	5,579	848,107
Other structural shapes	48,385	4,098,002	40,239	3,303,806
Railway track material—				
Rails for railways	146,060	5,331,737	95,179	3,586,402
Rail joints, splice bars, fishplates, and tie-plates	20,491	1,520,626	11,637	935,053
Switches, frogs, and crossings	5,665	1,087,644	3,382	749,251
Railroad spikes	4,057	292,852	2,735	177,877
Railroad bolts, nuts, washers, and nut locks	2,387	321,526	1,758	270,945
Tubular products—				
Boiler tubes	19,507	2,493,907	14,686	2,004,538
Casing and oil-line pipe	113,584	11,861,066	62,106	6,707,743
Welded black pipe	103,266	9,275,651	57,070	5,448,956
Welded galvanized pipe	41,920	3,991,720	36,328	3,619,792
Malleable-iron screwed pipe fittings	12,534	3,926,819	10,742	3,413,299
Cast-iron screwed pipe fittings	15,038	2,362,122	6,055	1,426,971
Cast-iron pressure pipe and fittings	14,888	1,443,742	11,385	957,294
Cast-iron soil pipe and fittings	16,993	1,230,403	14,035	1,282,829
Wire and manufactures—				
Barbed	58,978	3,748,336	35,183	2,054,848
All other	71,086	9,769,681	44,519	6,257,168
Nails and bolts (except railroad)—				
Cut nails	898	100,437	473	55,880
Horseshoe nails	866	213,848	751	180,940
Wire nails	12,985	864,447	8,471	556,273
All other nails, including tacks and staples	8,490	1,169,495	4,645	818,743
Bolts, nuts, rivets, and washers (except railroad)	16,236	3,145,377	10,131	2,092,572
Castings and forgings—				
Horseshoes	439	68,726	181	32,102
Iron and steel, including car wheels and axles	55,334	8,315,309	39,297	6,297,210
Advanced manufactures:				
House-heating boilers and radiators		1,124,401		859,452
Tools—				
Axes		1,084,609		590,471
Hammers and hatchets		378,691		210,412
Saws, wood and metal cutting		2,212,521		1,684,122
Shovels and spades		339,859		218,206
All other tools		13,642,123		8,995,682

PLATINUM AND ALLIED METALS[1]

By Hubert W. Davis[2]

CONTENTS

	Page
Crude platinum	99
Refined platinum metals	99
New metals	99
Secondary metals	100
Imports and exports	101
Sales by refiners	103
Stocks	105
Market and prices	105
Crude platinum	105
Refined metals	105

	Pag
World production	106
Notes on production by countries	107
United States	107
Australasia	107
Canada	107
Chile	108
Colombia	108
Ethiopia (Abyssinia)	109
Russia	109
Sierra Leone	109
Union of South Africa	110

CRUDE PLATINUM

Mine returns for 1930 indicate a production of 385 troy ounces of crude platinum in Alaska, 129 ounces in California, and 13 ounces in Oregon—a total of 527 ounces for the United States. In 1929 Alaska produced 528 ounces, California 246 ounces, and Oregon 23 ounces—a total of 797 ounces.

Platinum refiners in the United States report purchases of domestic platinum in 1930, as follows: Alaska 513 ounces, California 236 ounces, Oregon 10 ounces, and unspecified 38 ounces—a total of 797 ounces or 281 ounces more than refiners purchased in 1929. Refiners in the United States also report purchases of 44,765 ounces of foreign crude platinum in 1930—547 ounces from Australia, 6 ounces from Canada, 40,520 ounces from Colombia, 2 ounces from Russia, and 3,690 ounces from South Africa. The total is 6,853 ounces less than the purchases reported in 1929. According to the Bureau of Foreign and Domestic Commerce, the imports of platinum from Colombia during 1930 were 43,155 ounces, a decrease of 6 per cent as compared with 1929, and the total imports of unmanufactured platinum in 1930 were 106,155 ounces, a decrease of 8 per cent.

REFINED PLATINUM METALS

NEW METALS

Reports of refiners of crude platinum, gold bullion, and copper indicate that 43,502 ounces of platinum metals were recovered in the United States from these sources in 1930, a decrease of 9 per cent as compared with recoveries in 1929. It is estimated that 9,308 ounces of the total in 1930 were derived from domestic sources.

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[1] Work on manuscript completed July, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

New platinum metals recovered by refiners in the United States, 1921–1930, in troy ounces

Year	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1921	51, 791	2, 686	286	581	1, 026	56, 370
1922	54, 142	1, 943	210	1, 301	122	57, 718
1923	46, 780	1, 934	280	787	16	49, 797
1924	57, 827	6, 065	680	1, 261	174	66, 007
1925	41, 300	7, 378	285	648	54	49, 643
1926	76, 154	6, 437	234	2, 113	43	84, 981
1927	41, 121	3, 879	226	631	163	46, 020
1928	51, 427	5, 148	1, 678	458	348	59, 059
1929	41, 760	5, 295	302	364	256	47, 977
1930	37, 780	3, 801	1, 468	334	119	43, 502

New platinum metals recovered by refiners in the United States, 1929 and 1930, by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1929						
Domestic:						
Crude platinum	369	2	17	53		441
Ore	2			1		3
Gold and copper refining	5, 249	5, 056	27		110	10, 442
	5, 620	5, 058	44	54	110	10, 886
Foreign: Crude platinum	36, 140	237	258	310	146	37, 091
Total recovery	41, 760	5, 295	302	364	256	47, 977
1930						
Domestic:						
Crude platinum	524	6	104	57	26	717
Gold and copper refining	4, 824	3, 650	24		93	8, 591
	5, 348	3, 656	128	57	119	9, 308
Foreign: Crude platinum	32, 432	145	1, 340	277		34, 194
Total recovery	37, 780	3, 801	1, 468	334	119	43, 502

The figures for 1930, given in the preceding tables, include the new platinum metals recovered by the following concerns in the United States:

American Platinum Works, Newark, N. J.
American Smelting & Refining Co., New York, N. Y.
Baker & Co. (Inc.), Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Sigmund Cohn, New York, N. Y.
Kastenhuber & Lehrfeld, New York, N. Y.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Raritan Copper Works, Perth Amboy, N. J.
Schwitter, Clover & Starkweather (Inc.), Newark, N. J.
United States Assay Office, New York, N. Y.
United States Metals Refining Co., Carteret, N. J.
United States Mint, San Francisco, Calif.
United States Mint, Denver, Colo.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.

SECONDARY METALS

Secondary platinum metals are those recovered from the treatment of scrap metal, sweeps, and other waste products of manufacture that contain platinum.

Secondary platinum metals recovered in the United States, 1921–1930, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1921	39, 131	4, 887	1, 776	229	46, 023
1922	40, 062	4, 193	1, 937	496	46, 688
1923	39, 152	6, 246	2, 021	453	47, 872
1924	45, 474	5, 784	2, 200	1, 013	54, 471
1925	35, 578	4, 680	1, 827	1, 189	43, 274
1926	38, 795	5, 647	1, 478	217	46, 137
1927	46, 127	4, 244	1, 810	891	53, 072
1928	47, 157	4, 156	2, 090	2, 428	55, 831
1929	33, 638	5, 120	2, 057	1, 944	42, 759
1930	33, 787	7, 426	4, 354	1, 749	47, 316

The figures for 1930, given in the foregoing table, include the secondary platinum metals recovered by the following concerns in the United States:

American Platinum Works, Newark, N. J.
Baker & Co. (Inc.), Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Cincinnati Gold & Silver Refining Co., Cincinnati, Ohio.
Clinton Refining Co. (Inc.), Newark, N. J.
Thomas J. Dee & Co., Chicago, Ill.
Dentists' Supply Co. of New York, York, Pa.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
S. B. Gracier & Sons, San Francisco, Calif.
T. B. Hagstoz & Son, Philadelphia, Pa.
Handy & Harman, New York, N. Y.
Hoover & Strong (Inc.), Buffalo, N. Y.
Irvington Smelting & Refining Works, Irvington, N. J.
Kastenhuber & Lehrfeld, New York, N. Y.
Michigan Refining Works, Pontiac, Mich.
J. M. Ney Co., Hartford, Conn.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), Newark, N. J.
Standard Platinum Co., New York, N. Y.
Tiffany & Co., New York, N. Y.
United States Metals Refining Co., Carteret, N. J.
United States Mint, San Francisco, Calif.
United States Mint, Denver, Colo.
Western Electric Co., Chicago, Ill., and Kearny, N. J.
Western Gold & Platinum Works, San Francisco, Calif.
S. S. White Dental Manufacturing Co., Prince Bay, N. Y.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.
Williams Gold Refining Co. (Inc.), Buffalo, N. Y.

IMPORTS AND EXPORTS

Platinum metals imported for consumption in the United States, 1921–1930

Year	Troy ounces	Value	Year	Troy ounces	Value
1921	78, 378	$5, 418, 464	1926	134, 797	$13, 451, 835
1922	110, 025	8, 983, 547	1927	148, 769	12, 413, 494
1923	106, 637	10, 466, 705	1928	135, 233	9, 357, 737
1924	111, 359	11, 030, 349	1929	155, 075	9, 119, 479
1925	125, 802	13, 230, 148	1930	139, 246	5, 836, 492

Platinum metals imported for consumption in the United States, 1929 and 1930, by metals

Metal	1929		1930	
	Troy ounces	Value	Troy ounces	Value
Platinum:				
Ores of platinum metals (platinum content)	564	$43, 152		
Grains, nuggets, sponge, or scrap	74, 063	4, 466, 149	81, 229	$3, 363, 858
Ingots, bars, sheets or plates, not less than ⅛-inch thick	40, 594	2, 640, 097	24, 926	961, 334
	115, 221	7, 149, 398	106, 155	4, 325, 192
Manufactures of, except jewelry	2	697	25	520
Iridium	4, 470	887, 893	4, 196	665, 475
Osmiridium	6, 863	391, 025	5, 654	319, 292
Osmium	1, 124	70, 515	1, 100	65, 642
Palladium	24, 364	532, 285	18, 506	353, 772
Rhodium	2, 073	61, 849	2, 291	69, 717
Ruthenium	958	25, 817	1, 319	36, 882
	155, 075	9, 119, 479	139, 246	5, 836, 492

Platinum metals (unmanufactured) imported into the United States, 1929 and 1930, by countries, in troy ounces

[General imports]

Country	Platinum			Iridium	Osmium and osmiridium	Palladium	Rhodium and ruthenium	Total
	Ores of platinum metals (platinum content)	Grains, nuggets, sponge, or scrap	Ingots, bars, sheets or plates, not less than ⅛-inch thick					
1929								
Canada		679	24	1		815		1, 519
Chile		58						58
China		9						9
Colombia		45, 756		258	5			46, 019
Costa Rica		328						328
France					52		50	102
Germany		4, 337	8, 475	2, 058	235	11	400	15, 516
Japan		200	4, 700					4, 900
Soviet Russia in Europe		4, 908	9, 072	513				14, 493
Union of South Africa	350							350
United Kingdom	214	17, 788	18, 323	1, 640	7, 685	23, 538	2, 581	71, 769
	564	74, 063	40, 594	4, 470	7, 977	24, 364	3, 031	155, 063
1930								
Australia		14		35	25			74
Canada		312			44	28		384
China			200					200
Colombia		43, 155			8			43, 163
France			33					33
Germany			401	2, 720		208		3, 329
Japan			1, 700	10	6			1, 716
Soviet Russia in Europe		5, 317	9, 079	512	442			15, 350
United Kingdom		32, 431	13, 513	919	6, 229	18, 270	3, 610	74, 972
		81, 229	24, 926	4, 196	6, 754	18, 506	3, 610	139, 221

Platinum exported from the United States, 1921–1930

Year	Unmanufactured		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1921	3,272	$244,473	741	$85,216
1922 Crude, scrap, and old	143	13,149	486	35,967
1922 Ingots, sheets, wire, and alloys	1,313	127,047		
1923	1,151	128,599	592	65,073
1924	5,854	643,282	1,274	136,948
1925	16,234	1,787,122	3,537	249,975
1926	11,573	1,253,795	1,898	160,648
1927	19,923	1,577,560	1,549	128,875
1928	9,050	619,478	2,168	160,554
1929	2,567	193,122	1,455	112,252
1930	1,037	62,072	769	40,850

Platinum exported from the United States, 1929 and 1930, by countries

Country	Unmanufactured (ingots, sheets, wire, alloys, and scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1929				
Argentina	128	$8,480	247	$14,800
Australia	1	195		
Barbados			7	479
Brazil	264	21,852	157	14,926
Canada	421	36,280	569	39,882
Chile	4	144	1	46
China	6	241		
Dominican Republic			2	298
Germany	1	165	133	12,100
Haiti			2	61
Japan	186	4,750	11	1,200
Malaya (British)			1	37
Mexico	5	367	7	576
Peru			13	403
Philippine Islands			15	1,575
Surinam			1	117
United Kingdom	1,551	120,648	289	25,752
	2,567	193,122	1,455	112,252
1930				
Argentina	1	14		
Brazil	119	8,531	52	3,555
Canada	739	43,327	176	8,993
Chile	4	888	1	118
China			13	814
France	47	406		
Japan			6	393
Mexico	(1)	186	19	530
Nicaragua			1	35
Peru			3	208
Soviet Russia in Europe			270	8,270
United Kingdom	127	8,720	228	17,934
	1,037	62,072	769	40,850

[1] Quantity not recorded.

SALES BY REFINERS

The following table shows the sales of platinum metals to consumers by refiners in the United States in 1929 and 1930. The figures include the sales by refiners in the United States of platinum metals recovered from crude platinum, from gold bullion, from copper and nickel bullion and matte, from electrolytic muds, and from scrap materials and sweeps; in addition they include the sales of considerable quantities of imported platinum metals which are handled by refiners in the United States.

Platinum metals sold by refiners in the United States, 1929 and 1930, by consuming industries, in troy ounces

Industry	Platinum	Palladium	Iridium	Others	Total	Percentage of total
1929						
Chemical	20, 260	1, 345	113	233	21, 951	11
Electrical	20, 746	18, 856	1, 014	89	40, 705	21
Dental	13, 051	12, 156	788	236	26, 231	14
Jewelry	84, 039	4, 451	3, 737	851	93, 078	49
Miscellaneous	7, 234	1, 048	347	1, 025	9, 654	5
	145, 330	37, 856	5, 999	2, 434	191, 619	100
1930						
Chemical	15, 022	854	34	49	15, 959	13
Electrical	8, 529	9, 569	864	70	19, 032	16
Dental	11, 810	15, 436	111	6	27, 363	23
Jewelry	44, 801	2, 807	2, 407	526	50, 541	43
Miscellaneous	3, 324	1, 621	208	876	6, 029	5
	83, 486	30, 287	3, 624	1, 527	118, 924	100

A list of the concerns whose sales to consumers in 1930 are included in the preceding table follows.

American Platinum Works, Newark, N. J.
Baker & Co. (Inc.), Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Cincinnati Gold & Silver Refining Co., Cincinnati, Ohio.
Clinton Refining Co. (Inc.), Newark, N. J.
Sigmund Cohn, New York, N. Y.
Thomas J. Dee & Co., Chicago, Ill.
Dentists' Supply Co. of New York, York, Pa.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
S. B. Gracier & Sons, San Francisco, Calif.
T. B. Hagstoz & Son, Philadelphia, Pa.
Handy & Harman, New York, N. Y.
Hoover & Strong (Inc.), Buffalo, N. Y.
Kastenhuber & Lehrfeld, New York, N. Y.
Metz Platinum Refining Co., Newark, N. J.
Michigan Refining Works, Pontiac, Mich.
J. M. Ney Co., Hartford, Conn.
Pacific Platinum Works (Inc.), Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), Newark, N. J.
Standard Platinum Co., New York, N. Y.
Tiffany & Co., New York, N. Y.
Trautz Co. (Inc.), Newark, N. J.
L. E. Waterman & Co., New York, N. Y.
Western Electric Co., Chicago, Ill., and Kearny, N. J.
Western Gold & Platinum Works, San Francisco, Calif.
S. S. White Dental Manufacturing Co., Prince Bay, N. Y.
Wildberg Bros. Smelting & Refining Co., San Francisco, Calif.
Williams Gold Refining Co., Buffalo, N. Y.
H. A. Wilson Co., Newark, N. J.

Sales of platinum metals in 1930, as reported by the foregoing concerns, were 118,924 ounces, as compared with 191,619 ounces in 1929, a decrease of 38 per cent. Sales of platinum metals to the chemical, electrical, and jewelry industries decreased in 1930, the most significant decrease being that of 42,537 ounces in sales to the jewelry industry. Only the dental industry purchased more platinum metals in 1930 than in 1929, this outlet recording an increase of 1,132 ounces.

STOCKS

Stocks of platinum metals in the hands of refiners on December 31, 1930, amounted to 88,665 ounces, an increase of 8 per cent as compared with stocks at the beginning of the year.

Stocks of platinum metals in the hands of refiners in the United States, December 31, 1921–1930, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1921	38, 514	21, 042	4, 991	3, 113	67, 660
1922	41, 900	24, 975	7, 559	1, 583	76, 017
1923	36, 554	26, 266	5, 208	2, 697	70, 725
1924	40, 464	27, 400	3, 622	3, 053	74, 539
1925	44, 024	26, 740	3, 720	4, 609	79, 093
1926	64, 203	31, 950	3, 933	5, 485	105, 571
1927	68, 757	24, 313	4, 617	4, 369	102, 056
1928	45, 710	23, 018	4, 523	5, 019	78, 270
1929	51, 853	20, 154	4, 716	5, 461	82, 184
1930	52, 853	18, 978	8, 828	8, 006	88, 665

MARKET AND PRICES

CRUDE PLATINUM

Sellers of domestic crude platinum reported that they were paid for metal content based on assay. Buyers reported purchases at $30 to $40 an ounce for domestic and $20 to $105 an ounce for foreign crude platinum. Buyers of foreign and domestic crude platinum in the United States who reported purchases in 1930 are as follows:

American Platinum Works, 225 New Jersey Railroad Avenue, Newark, N. J.
Baker & Co. (Inc.), 54 Austin Street, Newark, N. J.
J. Bishop & Co. Platinum Works, Malvern, Pa.
Sigmund Cohn, 44 Gold Street, New York, N. Y.
Thomas J. Dee & Co., 1010 Mallers Building, Chicago, Ill.
Kastenhuber & Lehrfeld, 24 John Street, New York, N. Y.
Pacific Platinum Works (Inc.), 814 South Spring Street, Los Angeles, Calif.
Schwitter, Clover & Starkweather (Inc.), 312 Passaic Avenue, Newark, N. J.
Wildberg Bros. Smelting & Refining Co., 742 Market Street, San Francisco, Calif.

REFINED METALS

Quotations [3] based on official prices quoted by a leading interest on small miscellaneous orders for refined platinum were $63 an ounce from January 2 to January 23, after which there were frequent reductions until September 17, when a drop in the price to $34 an ounce was announced. On September 22 an increase to $36 an ounce (the closing price for 1930) was indicated. The average of these quotations was $45.36 an ounce. Refiners reported the high price of platinum at $70, the low at $27, and the average for the year at $44 an ounce.

Iridium, 98 and 99 per cent sponge and powder, was quoted at $210 to $220 an ounce on January 2, but by the middle of May several reductions had brought the price down to $150 to $155 an ounce. On May 15 the price was increased to $200 to $210 an ounce, and on June 12 a further increase to $250 to $265 an ounce became effective.

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[3] Engineering and Mining Journal, vols. 129 and 130, 1930.

On July 10 the price dropped to $240 to $265 an ounce and further drops were announced on August 14 and 28, September 11, and December 11, when a price of $180 to $200 an ounce was reached. Refiners gave the following prices: High, $260; low, $100; and average for the year, $179 an ounce.

The price of palladium, like that of each of the other platinum metals, also was considerably reduced during 1930. Quotations on palladium at the beginning of 1930 were $35 to $36 an ounce, but after numerous reductions the price reached $19 to $23 an ounce in September. On September 25 an increase to $22 to $23 an ounce became effective and was maintained until December 11, when the price was reduced to $20 to $22 an ounce, the closing quotation for the year. Refiners reported a high of $40, a low of $16, and an average price for the year of $24 an ounce.

The quoted price on rhodium during 1930 ranged from $45 to $55 an ounce; that on osmium from $60 to $75 an ounce; and that on ruthenium from $35 to $48 an ounce.

WORLD PRODUCTION

World production of crude platinum from placers, 1922–1930, in troy ounces

Country	1922	1923	1924	1925	1926	1927	1928	1929	1930
Australasia:									
New South Wales	80	586	646	573	397	226	354	128	155
New Zealand					31	33	35	7	3
Papua (osmiridium) [1]	100	[2] 145	[2] 119	[2] 116	[2] 49	60	215	[2] 29	29
Tasmania (osmiridium)	1,174	673	365	3,366	3,173	633	1,627	1,360	953
Canada	[3] 15	[3] 10	5	6	50	11	49	28	12
Colombia	[4] 40,000	[4] 42,000	[4] 46,000	[4] 45,000	[5] 44,565	[5] 45,830	[5] 53,531	[5] 45,577	[5] 42,382
Ethiopia					480	2,251	3,247	7,716	8,038
Japan	150	224	145	189	198	47	100	147	(6)
Madagascar							2		
Mexico					30				(6)
Philippine Islands	1	14		4	8	31			(6)
Russia	[7] 27,200	[7] 38,000	[7] 66,841	[7] 94,780	[7] 92,691	[8] 100,000	[9] 78,925	[10] 99,667	(6)
Sierra Leone								26	546
United States	1,008	609	335	343	286	153	528	797	527

[1] For year ended June 30 of year stated.

[2] Exports.

[3] Estimated by J. M. Hill. The Dominion Bureau of Statistics Ann. Repts. give the placer output of Canada, in troy ounces, as follows: 1922, 12; 1923, 7.

[4] Estimated.

[5] Based on data personally communicated to the author.

[6] Data not available.

[7] Figures as published by the Geological Committee, Russia, in Annual Rept. on the mineral resources of the U. S. S. R., vol. 1, Leningrad, 1927.

[8] Estimated production, Imp. Inst., London; includes recoveries from imported concentrates.

[9] Exports; year ended Sept. 30.

[10] Year ended Sept. 30.

The following table gives data by which the figures showing the production of crude platinum as given in the foregoing table can be reduced to terms of the refined metals used by the industries.

Average assay of crude platinum, in per cent

Country	Platinum	Palladium	Iridium	Osmium	Rhodium, ruthenium, etc.
Australasia:					
New South Wales	75.9		1.3		1.3
Papua			58.1	33.5	3.0
Tasmania			58.1	33.5	3.0
Canada	72.1	0.2	1.1		2.8
Colombia	86.69	.54	[1] .85		
Japan	.2		19.8	37.3	3.9
Russia	83.5	1.9	1.9	3.0	.6
United States	85.5	.6	1.1	1.3	1.0

[1] Iridium and osmiridium.

NOTES ON PRODUCTION BY COUNTRIES

UNITED STATES

The mine production of Alaska, as reported by the United States Geological Survey, amounted to 385 ounces of crude platinum in 1930, as compared with 528 ounces in 1929. The production in both years was from placers in the Goodnews Bay region south of the mouth of Kuskokwim River and from Dime Creek in the Koyuk district, Seward Peninsula.

In California mining companies reported the production of 129 ounces of platinum in 1930, as compared with 246 ounces in 1929.

The production of platinum in Oregon in 1930 was 13 ounces, as compared with 23 ounces in 1929.

AUSTRALASIA

Production of platinum metals in Australasia in 1930 was as follows: 155 ounces of platinum from New South Wales (128 ounces in 1929), 2½ ounces of platinum from New Zealand (7 ounces in 1929), 29 ounces of osmiridium from Papua (29 ounces also in 1929), and 953 ounces of osmiridium from Tasmania (1,360 ounces in 1929).

All the platinum produced in New South Wales in 1930 was from the Fifield division. At the end of 1929 about 30 men were engaged in prospecting. R. Finlay shipped 10 long tons of platinoid ore overseas for experimental treatment from a site approximately 15 miles east of Broken Hill.[4]

CANADA

The production of crude platinum from placers in Canada in 1930 was 12 ounces, as compared with 28 ounces in 1929.[5] Recoveries of platinum metals in 1930 from Canadian ores amounted to 34,001 ounces of platinum and 34,063 ounces of other platinum-group metals, as compared with 12,491 ounces of platinum and 17,318 ounces of other platinum-group metals recovered in 1929.

With the exception of a few ounces of platinum obtained from the black sands of British Columbia and a small production obtained as an impure residue in the refining of gold at Trail, British Columbia, all the Canadian platinum and allied metals are obtained from the treatment of the Sudbury nickel-copper matte.[6]

The successful development of the Frood and Frood Extension copper-nickel mines near Sudbury and the enlargement of the Acton refinery near London, England, in which the precious-metal content of concentrates produced at Port Colborne from Sudbury ores is recovered, have added considerably to the Canadian production of metals of the platinum group. The Engineering and Mining World [7] describes the Acton refinery as follows:

> The Acton precious-metals refinery, situated in a London suburb, recovers in a refined state the precious-metal content of concentrates produced at both the

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[4] New South Wales Department of Mines, Annual Report for the Year 1929: Sydney, 1930, p. 31.

[5] Dominion Bureau of Statistics, Preliminary Report on the Mineral Production of Canada during the Calendar Year 1930: Ottawa, 1931.

[6] Canada Department of Mines, Mines Branch, The Canadian Mineral Industry in 1930: Ottawa, 1931, p. 12.

[7] Engineering and Mining World, All International Nickel's Precious Metals Refined at the Acton Plant: Vol. 1, November, 1930, p. 647.

Clydach and Port Colborne nickel refineries. It is now the largest platinum refinery in the world, the enlargements effected this year having raised its yearly capacity to at least 300,000 ounces of platinum-group metals. The plant is thus prepared to refine platinum from other sources on a custom basis.

Necessarily, the process is an intricate one, as seven metals—platinum, palladium, rhodium, ruthenium, iridium, gold, and silver—are to be separated not only from one another but from a gross assortment of other substances contained in the raw material. Long and painstaking study and research have developed the process as now used to a degree of perfection that is indicated by the high purity of its products as shown in the following average analyses over many months: Platinum, 99.93 per cent; palladium, 99.94; rhodium, 99.76; ruthenium, 99.72; iridium, 99.68; gold, 99.97; and silver, 99.97 per cent. These figures give point to the statement that the plant actually is a chemical laboratory on a large scale.

Acton refinery's place in the economic structure of the platinum market is unique, for, unlike the other platinum refineries, it is dealing with concentrates which are a by-product of ores which are primarily worked for the recovery of other metals. Therefore, the mining and treatment costs up to the refining stage may be considered as having been absorbed in the cost of producing nickel and copper. The process developed at Acton is highly efficient and operates at a low cost.

By the middle of 1930 the annual rate of production was as stated in the table, and it is steadily increasing. Further production from the Frood mine will materially increase the amounts of precious metals produced.

Production of precious metals

	Troy ounces
Platinum	50, 000
Palladium	26, 000
Rhodium	3, 300
Ruthenium	700
Iridium	500
Gold	4, 800
Silver	96, 000

Concentrates from Port Colborne contain from 45 to 60 per cent of platinum metals; those from Clydach about 4 per cent, with considerable lead and silver. As Clydach is now dealing with washed sulphide from Port Colborne instead of bessemer matte, its concentrate will in future contain less lead and silver and much more platinum metals.

The new silver-refining unit to recover silver, gold, and metals of the platinum group from slimes precipitated in the process of refining International Nickel blister copper at the Ontario refining plant, Copper Cliff, Ontario, was put in operation late in October, 1930.[8]

CHILE [9]

Platinum deposits described as the richest in the world have been discovered, according to an Associated Press message from Santiago de Chile, on the Island of Chiloe, Chile. It is claimed that the yield of metal is 12 to 14 grams per ton, and tests made in England and Germany are said to confirm the claim.

COLOMBIA

The exports of crude platinum from Colombia in 1930 were 42,382 ounces, of which 27,557 ounces was the product of dredges and 14,825 ounces was the product of hand working by native operators. Refiners of platinum metals in the United States reported purchases of 40,520 ounces of Colombian crude platinum in 1930, as compared with 45,687 ounces in 1929.

The South American Gold & Platinum Co. in 1930 produced 27,573 ounces of crude platinum and 9,048 ounces of gold, as compared with 23,400 ounces of crude platinum and 8,054 ounces of gold in 1929.

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[8] Canadian Mining Journal, Silver Refinery in Operation at Copper Cliff: Vol. 51, Nov. 14, 1930, p. 1005.

[9] Mining Journal (London), vol. 172, Jan. 31, 1931, p. 103.

ETHIOPIA (ABYSSINIA)

The production of crude platinum in Ethiopia in 1930 was 8,038 ounces, as compared with 7,716 ounces in 1929.

According to the Canadian Mining Journal[10]—

> Abyssinia is the latest country to produce platinum commercially. A French company, Société Minière des Concessions Prasso, has been conducting investigations of platinum placers, and its report for 1929 shows a substantial profit from an output of 100 kilograms of the metal. The payability of the placers having now been demonstrated by hand washing it is intended to install hydraulic machinery and to conduct more extensive operations.

The platinum deposits of Ethiopia have been described in some detail by Kuntz.[11]

RUSSIA

No authentic statistics on the production of platinum in Soviet Russia in 1930 are available, but it is estimated at 120,000 ounces by the Mining Journal.[12] The Soviet platinum output for the fiscal year ended September 30, 1929, according to Jewelers' Circular,[13] is reported to have reached a total of 3,100 kilograms (99,667 ounces), with a further material increase in the production of the Ural platinum mines and refineries marking the first eight months of the current business year.

SIERRA LEONE [14]

> One mining lease and 11 exclusive prospecting licenses for platinum were granted during the year and permission to mine was granted on one mining right application. The ground applied for lies on the seaward side of the mountains between Baw Baw and the Whale River estuary and covers the area in which the writer obtained his most promising prospects in 1926 and 1927. Very little prospecting has been done in outside areas, although alluvial platinum was found by the writer in several other places; that is, in a small stream at Ogu farm, in tributaries of the Benguema stream heading from York Pass, and in tributaries of the Orugu River.
>
> Apart from a little prospecting near York Pass practically no work has yet been done within the forest reserve. The absence of villages, the scarcity of tracks, and the density of the vegetation in the reserve combine to make prospecting very difficult.
>
> Towards the end of October mining operations were commenced on the rich alluvial deposits in the Big Water near York Pass. A good deal of the platinum is coarse and angular—pieces ranging from ½ dwt. to 3 or 4 dwts. are fairly common—and is obviously of quite local origin. Most of the platinum is tin white or pale bronze in color; some of it is magnetic and a little of it exhibits polarity. Ilmenite and a little magnetite are associated with the platinum, and small nuggets of platinum intergrown with ilmenite have been found in the course of mining operations. Chromite is very rare. A sample of the crude black sand obtained by panning the platiniferous gravels assayed 46.8 per cent TiO_2 and only 0.29 per cent Cr_2O_3. The black sand contains a good deal of finely divided platinum which can not be readily separated by panning.
>
> The United Africa Co. has recently found coarse angular platinum, including a nugget of 9 dwts., in the eluvium and alluvium on the slope of the ridge between Big Water and Kotakota creek. The distribution of the platinum and the sharp unworn edges of the grains indicate that the source of the platinum is near at hand. Pits are now being sunk on the slopes of this ridge with the object of finding the platinum in situ.

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[10] Canadian Mining Journal, Platinum in Abyssinia: Vol. 51, Sept. 12, 1930, p. 903.

[11] Kuntz, J., Eine geologisch-bergmännische Expedition durch Abessinien. (A geologic and mineral expedition through Abyssinia): Freiberger geol. Gesell., Ber. 13, Freiberg i. S., 1931, pp. 74–80.

[12] Mining Journal (London), vol. 172, Jan. 24, 1931, p. 8.

[13] Jewelers' Circular, vol. 100, May 29, 1930, p. 41.

[14] Junner, N. R., Report of the Geological Department of Sierra Leone for the Year 1929: Freetown. 1930, p. 7.

According to Lumb,[15] at present the United Africa Co. (Ltd.) is producing 80 ounces of platinum a month by simple alluvial methods.

UNION OF SOUTH AFRICA

The shipments of platinum in South Africa in 1930 were 47,021 ounces, valued at £327,884, or £6.97 an ounce, as compared with 21,608 ounces, valued at £221,645, or £10.26 an ounce, in 1929.

The shipments of osmiridium in 1930 were 5,619 ounces, valued at £69,267, or £12.33 an ounce, as compared with 5,712 ounces, valued at £87,243, or £15.27 an ounce, in 1929. Details of the production and sales of osmiridium in 1929 are as follows:[16]

Production and sales of osmiridium in South Africa in 1929, by districts

District	Production (ounces)	Sales	
		Ounces	Value
Witwatersrand:			
Large mines	5, 151. 543	5, 053. 28	£75, 577
Metallurgical works and small mines	637. 290	637. 29	11, 192
Heidelberg	21. 450	21. 45	474
	5, 810. 283	5, 712. 02	87, 243

Composition of osmiridium sold in South Africa in 1929

Metal	Per cent	Weight of metal (troy ounces)	Metal	Per cent	Weight of metal (troy ounces)
Osmium	31. 42	1, 794. 686	Gold	1. 13	64. 304
Iridium	28. 72	1, 640. 548	Balance (undetermined)	14. 02	801. 078
Ruthenium and rhodium	13. 74	785. 000			
Platinum	10. 97	626. 404		100. 00	5, 712. 020

In addition to the platinum contained in the osmiridium recovered in the treatment of gold ores, mining for platinum was carried on throughout 1929 in the Potgietersrust, Lydenburg, and Rustenburg districts. The output of these districts in 1929 follows:

Production of platinum in the Potgietersrust, Lydenburg, and Rustenburg districts in 1929

	Quantity	Assay	Estimated contents platinum metals (ounces)
Crude platinum	46, 902. 750 ounces	51. 35 per cent	24, 083. 424
Concentrates	315. 488 tons	18. 16 ounces per ton	5, 730. 489
			29, 813. 913

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[15] Lumb, A. D., Platinum in Sierra Leone: Min. Jour. (London), vol. 169, May 17, 1930, p. 409.

[16] Union of South Africa, Department of Mines and Industries, Annual Report of the Government Mining Engineer for the Calendar Year ended Dec. 31, 1929: Pretoria, 1930.

Composition of platinum sold in South Africa in 1929

Metal	Ore (per cent)			Weight of metal (troy ounces)
	Dunite	Norite	Average	
Platinum	94.85	62.78	82.92	17,917.098
Palladium	1.70	31.48	12.77	2,760.780
Iridium	.56	.55	.56	120.746
Osmium	.68	.08	.46	98.877
Rhodium	1.41	.56	1.10	237.172
Ruthenium	.68	.45	.59	128.024
Gold	.12	4.10	1.60	345.183
	100.00	100.00	100.00	21,607.880

The sales of osmiridium and platinum in South Africa since the beginning of operations are shown in the following table:

Sales of osmiridium and platinum in South Africa, 1921–1930, in ounces

Year	Osmiridium	Platinum	Year	Osmiridium	Platinum
1921	510		1927	5,653	10,431
1922	762		1928	5,991	17,828
1923	1,784		1929	5,712	21,608
1924	4,107		1930	5,619	47,021
1925	6,055				
1926	6,360	4,951		42,553	101,839

As shown in the foregoing table, the sales of osmiridium in South Africa in 1930 were only slightly less than in 1929. The sales of platinum, however, were about 118 per cent greater than in 1929. Notwithstanding the large increase in sales of platinum in 1930, the enlargement of the Acton refinery, near London, of the International Nickel Co. is viewed with much alarm by the South African Mining and Engineering Journal, which comments as follows:[17]

> In the absence, meanwhile, of any reassuring statement from South African platinum interests, we fear that the enlargement of the Acton refinery, near London, of the International Nickel Combine must be taken as the writing on the wall, as far as the South African industry is concerned. It will be remembered that we published an account of this platinum metals refinery six weeks ago, which showed that the enlarged works would have a capacity of 300,000 ounces of platinum metals per annum and that the cost of refining would be not the £2 per ounce which had previously been suggested but in the neighborhood of 10s. per ounce. The capacity mentioned is at least comparable with, if not equal to, the world's absorptive capacity for the metals concerned, namely, platinum, palladium, rhodium, ruthenium, and iridium, while the cost of refining mentioned is in effect the cost of production, because the concentrates treated at Acton are forthcoming automatically from the nickel refineries, without appreciable increase in the cost of producing nickel. The output of these platinum metals from Acton depends on two factors, the amount of nickel which International Nickel can sell and the precious metal content of the ores under current treatment. Since the war the nickel industry, faced with a huge diminution in the demand for its product for armament purposes, has been engaged in research and propaganda aiming at an increased use of nickel in peaceful industry, and this work has been signally successful. The remarkable disclosures in depth in the Frood ore bodies at Sudbury, Ontario, have not only increased the base-metal resources of Inter-

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[17] South African Mining and Engineering Journal, By-Product Platinum: Vol. 41, pt. 2, Sept. 13, 1930, p. 37.

> national Nickel but have pointed to a more than proportional increase in precious metal resources, and it is these disclosures which have led to a tenfold increase in the platinum metal refining capacity of the Acton works. Although crudes and concentrates from the Onverwacht Mine have hitherto been refined at Acton, this source has now been exhausted, and we fear that no part of the huge capacity of Acton is provided for the handling of South African platinum products. As production there will be, in a sense, automatic, and will cost so very little, the outlook for other producing countries is far from cheerful. Such a development could scarcely have been foreseen three or four years ago, when South Africa settled down seriously to the attainment of platinum production, but it is, to say the least, more unfortunate that by-product platinum promises to become the dominant factor in the world's markets, in respect of both output and price.

Powell,[18] however, takes a more optimistic view, stating that most of the difficulties associated with the recovery of the platinum metals from the norite deposits in South Africa have been successfully overcome; that the platinum industry in South Africa is now firmly established, in spite of the closing of some mines; that there is every prospect of further expansion in the near future as improved methods of treating the ore are introduced; and that in the future Canada and South Africa are likely to dominate the market for platinum.

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[18] Powell, A. R., The Precious Metals During 1929-30: Met. Ind. (London), vol. 38, Jan. 16, 1931, pp. 70-71.

LEAD AND ZINC PIGMENTS AND SALTS

By Elmer W. Pehrson [2]

CONTENTS

Page
Summary 113
Production 115
Source 117
Preparation and uses 118
White lead 118
Basic lead sulphate 120
Litharge 120
Red lead 121
Orange mineral 122
Zinc oxide 122

Page
Preparation and uses—Continued.

Leaded zinc oxide 123
Lithopone 123
Zinc salts 124
Producers and plants 125
Tariff 126
Imports and exports 127
Lead pigments 127
Zinc pigments and salts 128
Prices and value 130

SUMMARY

The total value of lead and zinc pigments sold by domestic producers amounted to approximately $69,253,000 in 1930, as compared with $98,045,000 in 1929, a decrease of 29 per cent. Sales of lead pigments decreased 33 per cent in value in 1930 and amounted to 53 per cent of the total value, whereas sales of zinc pigments declined 24 per cent and amounted to 47 per cent of the total.

The quantity of lead pigments sold by producers in 1930 amounted to 219,542 short tons, a decrease of 75,918 tons or 26 per cent. Each of the lead pigments shared in this decrease. Sales of white lead in oil decreased 35,280 tons or 34 per cent and were the lowest on record since 1905. Sales of dry white lead decreased 9,611 tons or 23 per cent. Other lead pigments showing large tonnage decreases in 1930 as compared with the preceding year were as follows: Litharge, 15,338 tons or 17 per cent; red lead, 10,080 tons or 23 per cent; and basic lead sulphate, 5,287 tons or 31 per cent. Sales of orange mineral decreased 47 per cent; however, the quantity produced is only a fraction of 1 per cent of the total production of lead pigments.

The quantity of zinc pigments sold by producers in 1930 amounted to 300,486 short tons, a decrease of 93,589 tons or 24 per cent. Sales of lithopone decreased 42,250 tons or 20 per cent; those of zinc oxide, 41,469 tons or 26 per cent; and those of leaded zinc oxide, 9,870 tons or 36 per cent.

Sales of zinc chloride and zinc sulphate decreased 33 and 16 per cent, respectively, as compared with 1929.

The marked decline in the pigment industry in 1930 reflected the sharp curtailment in the manufacture of paint, storage batteries, and rubber brought about by the general business depression. In previous periods of unemployment some paint-pigment manufacturers actually

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[1] Work on manuscript completed July, 1931.

[2] Statistics in this report prepared (unless otherwise indicated) by H. M. Meyer and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

enjoyed substantial increases in sales as many idle workers painted their homes while unemployed. In 1921 the sales of white lead in oil increased 28 per cent over those in 1920. At the beginning of 1930 a similar increase was expected, but the record now shows that in this respect 1930 was an exceptional year.

Market quotations for lead pigments declined about 1 cent per pound during 1930 as a result of the steady decline in the price of pig lead. The average price of lead pigments per ton, received in 1930 by producers reporting to the Bureau of Mines, was only 10 per cent below the 1929 average, whereas the average quoted price of pig lead in 1930 was 19 per cent below that in 1929. Quotations on zinc oxide and leaded zinc oxide were maintained at the levels of the three preceding years although the price of slab zinc (St. Louis) was 30 per cent lower in 1930 than in 1929. The quoted price of lithopone, which had remained unchanged for several years, dropped sharply during December, 1930, following a cut in the price of titanium pigment.

Imports of lead pigments in 1930 were negligible. Exports of lead pigments increased 21 per cent in quantity and 6 per cent in value and amounted to 5 per cent of the total quantity sold by domestic producers. The total quantity of white lead and sublimed lead exported increased 11 per cent, whereas that of the red oxides increased 43 per cent. The latter increase was due largely to increased exports to Netherland West Indies and the United Kingdom.

Imports of zinc pigments in 1930 decreased 18 per cent in quantity and 25 per cent in value and were equivalent in quantity to 3 per cent of the sales by domestic producers. Imports of lithopone decreased 17 per cent in 1930; they accounted for 85 per cent of the total quantity of zinc pigments imported. Imports of zinc sulphide, which increased rapidly from 1926 to 1929, declined 75 per cent in 1930. Exports of zinc pigments in 1930 declined 35 per cent in quantity and 34 per cent in value and amounted in quantity to less than 5 per cent of the total sales by domestic producers.

An outstanding feature of the lead and zinc pigment industry during the last few years has been the severe competition between white lead and other pigments for the paint trade. The effect of this is indicated roughly in the comparative sales of the pigments concerned. Sales of white lead in oil decreased from 153,000 tons in 1922 to 70,000 tons in 1930. During the same period the combined sales of zinc oxide and lithopone increased from 212,000 to 283,000 tons. As three-fourths of the lithopone and about one-third of the zinc oxide produced in the United States are used in the manufacture of paints, these figures indicate the marked degree to which the zinc pigments have invaded the paint industry at the expense of white lead.

The rapid expansion in the use of nitrocellulose paints in recent years has not altered materially the quantity of pigments consumed. The average nitrocellulose paint contains considerably less pigment per gallon than oil paints, but a heavy pigment priming coat and more finishing coats are used to offset the low pigment content. White lead is seldom used in these paints owing to its chemical instability in contact with nitrocellulose products. As it is desirable to have a low pigment content in nitrocellulose paints there has been an increased use of high hiding-power pigments such as high-strength lithopone and titanium pigments.

PRODUCTION

In this report the pigments and salts sold are considered as representing the production, no account being taken of the stocks on hand at the beginning and end of the year. The amounts used by producers at their own plants are included under sales.

The total value of the lead and zinc pigments sold by domestic producers was approximately $69,253,000 in 1930, as compared with $98,045,000 in 1929, a decrease of 29 per cent. Lead pigments sold in 1930 decreased 33 per cent in total value and 26 per cent in quantity, whereas zinc pigments sold decreased 24 per cent in both value and quantity as compared with 1929. The average value per ton of lead pigments sold in 1930, as reported by producers, declined only 10 per cent, whereas the average New York quotation for pig lead declined 19 per cent in 1930 as compared with 1929. Zinc pigments declined only 1 per cent in value per ton in 1930, as compared with a 30 per cent decrease in the St. Louis quotation for slab zinc.

The following tables show the sales of lead and zinc pigments and zinc salts from 1921 to 1930, as reported to the Bureau of Mines.

Lead pigments sold by domestic manufacturers in the United States, 1921–1930, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1921	26, 738	143, 545	11, 568	463	21, 805	381	41, 909
1922	41, 598	153, 393	13, 765	972	30, 509	370	58, 261
1923	37, 786	125, 087	11, 949	800	38, 037	646	75, 107
1924	42, 622	144, 872	14, 572	1, 088	36, 813	331	74, 724
1925	43, 426	120, 479	14, 996	1, 090	41, 669	840	86, 546
1926	37, 968	111, 845	12, 271	1, 236	42, 550	813	82, 540
1927	38, 669	119, 026	13, 482	1, 061	39, 073	709	81, 655
1928	42, 049	111, 923	16, 002	1, 234	40, 497	459	85, 570
1929	42, 159	104, 872	15, 580	1, 234	43, 021	678	87, 916
1930	32, 548	69, 592	10, 308	1, 219	32, 941	356	72, 578

Lead pigments sold by domestic manufacturers in the United States, 1929 and 1930

	1929			1930		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulphate or sublimed lead:						
White	15, 580	$2, 274, 917	$146	10, 308	$1, 321, 339	$128
Blue	1, 234	195, 849	159	1, 219	130, 017	107
Red lead	43, 021	7, 586. 543	176	32, 941	5, 066. 297	154
Orange mineral	678	165. 039	243	356	76, 655	215
Litharge	87, 916	13, 807, 087	157	72, 578	9, 713, 765	134
White lead:						
Dry	42, 159	6, 821, 200	162	32, 548	4, 572, 648	140
In oil	104, 872	23, 679, 875	226	69, 592	15, 505, 196	223

Zinc pigments and salts sold by domestic manufacturers in the United States, 1921–1930, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° Baumé)	Zinc sulphate
1921	74, 329	16, 103	55, 016	59, 457	3, 295
1922	128, 465	19, 613	83, 360	41, 627	5, 078
1923	126, 987	23, 504	98, 199	42, 431	5, 375
1924	131, 470	26, 729	109, 469	51, 054	4, 674
1925	151, 354	31, 750	147, 019	46, 619	[1] 5, 593
1926	146, 923	23, 859	170, 931	[1] 47, 296	[1] 6, 612
1927	151, 246	26, 064	176, 994	[1] 40, 141	[1] 6, 418
1928	160, 904	24, 223	200, 468	[1] 45, 669	[1] 4, 733
1929	160, 611	27, 149	206, 315	[1] 43, 189	7, 454
1930	119, 142	17, 279	164, 065	29, 043	6, 249

[1] Revised figures.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1929 and 1930

	1929			1930		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	160, 611	$20, 516, 246	$128	119, 142	$14, 896, 883	$125
Leaded zinc oxide [1]	27, 149	3, 224, 544	119	17, 279	2, 072, 197	120
Lithopone	206, 315	19, 773, 864	96	164, 065	15, 897, 683	97
Zinc chloride, 50° B	[2] 43, 189	[2] 1, 864, 431	[2] 43	29, 043	1, 247, 385	43
Zinc sulphate	7, 454	333, 837	45	6, 249	276, 728	44

[1] Zinc oxide containing 5 per cent or more of lead is classed as leaded zinc oxide.
[2] Revised figures.

Statistics for lead arsenate, lead acetate, zinc stearate, and other lead and zinc salts and compounds are collected biennially by the Bureau of the Census for odd years. The following tables show the production (exclusive of pigments, zinc chloride, and zinc sulphate) during the past few years, as compiled by that bureau.

Lead acetate, lead arsenate, and other lead salts (exclusive of lead pigments) produced in the United States, 1919, 1921, 1923, 1925, 1927, and 1929

Year	Lead acetate			Lead arsenate		Other salts
	Total production	Produced for sale				
	Short tons	Short tons	Value	Produced for sale (short tons)	Value	Value
1919	2, 566	2, 092	$552, 435	5, 733	$2, 090, 341	$335, 906
1921	1, 408	372	90, 305	4, 615	1, 629, 446	120, 327
1923	2, 753	616	160, 133	5, 378	2, 229, 431	388, 868
1925	3, 432	1, 251	359, 686	5, 969	1, 777, 552	192, 995
1927	(1)	1, 508	395, 122	[2] 10, 764	[2] 3, 190, 257	254, 809
1929	(1)	1, 042	255, 753	[2] 14, 952	[2] 3, 304, 351	186, 736

[1] Not given.
[2] The statistics for 1927 and 1929 are not comparable with those for preceding years as the figures prior to 1927 do not include data for the production reported by establishments engaged primarily in the manufacture of patent and proprietary medicines and compounds.

Zinc stearate and other salts and compounds of zinc (exclusive of zinc pigments, zinc chloride, and zinc sulphate) produced in the United States, 1923, 1925, 1927, and 1929

Year	Zinc stearate		Other salts and compounds, value
	Short tons	Value	
1923	227	$107,319	$410,913
1925	393	169,051	420,944
1927	391	164,927	376,666
1929	727	320,203	(1)

[1] Not given.

SOURCE

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and miscellaneous secondary materials such as scrap and waste materials from various industrial processes.

The following table gives the quantity and source of the metal contained in the lead pigments and in the zinc pigments and salts produced in the United States in 1929 and 1930. It shows that in 1930, 96.3 per cent of the lead in lead pigments was derived from pig lead, 3.4 per cent from ore, and 0.3 per cent from secondary material. For zinc pigments and salts the proportions were 67.9 per cent from ore, 17.6 per cent from slab zinc, and 14.5 per cent from secondary material.

Metal content of lead pigments and zinc pigments and salts produced by domestic manufacturers, 1929 and 1930, by sources, in short tons

Source	1929		1930	
	Lead in pigments [1]	Zinc in pigments and salts	Lead in pigments [1]	Zinc in pigments and salts
Domestic ore	9,429	[2] 138,104	6,686	104,561
Metal	248,657	39,620	190,182	27,090
Secondary material [3]	2,427	[2] 26,795	689	22,304
	260,513	[2] 204,519	197,557	153,955

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide. The metal content of lead acetate and lead arsenate is not available, as no canvass of their production is made by the Bureau of Mines. Moreover, these salts are derived from pig lead, and their metal content has already been taken into statistical account in the figures covering lead production.

[2] Revised figures.

[3] Zinc ashes, skimmings, drosses, and old metal.

In the following tables the source of the metal used in the manufacture of each pigment and salt is given. Pig lead is used exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and, to a large extent, in the manufacture of basic lead sulphate. Zinc oxide is the only pigment in which slab zinc is used in considerable amounts. Ore is used in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulphate, and basic lead sulphate. Considerable secondary lead is used in the manufacture of basic lead sulphate, and a substantial proportion of the zinc in lithopone and zinc chloride made in the United States is derived from secondary material.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1929 and 1930, by sources, in short tons

Pigment	1929				1930			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material		Domestic ore	Pig lead	Secondary material	
White lead	-------	120, 046	-------	120, 046	-------	87, 329	-------	87, 329
Red lead	-------	39, 375	-------	39, 375	-------	30, 493	-------	30, 493
Litharge	-------	82, 670	-------	82, 670	-------	67, 510	-------	67, 510
Orange mineral	-------	702	-------	702	-------	222	-------	222
Basic lead sulphate	4, 213	5, 864	1, 682	11, 759	1, 953	4, 628	636	7, 217
Leaded zinc oxide	5, 078	-------	745	5, 823	4, 693	-------	53	4, 746
Zinc oxide	138	-------	-------	138	40	-------	-------	40
	9, 429	248, 657	2, 427	260, 513	6, 686	190, 182	689	197, 557

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1929 and 1930, by sources, in short tons

Pigment or salt	1929				1930			
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	Zinc in pigments and salts produced from—			Total zinc in pigments and salts
	Domestic ore	Slab zinc	Secondary material		Domestic ore	Slab zinc	Secondary material	
Zinc oxide	97, 263	39, 600	72	136, 935	71, 324	27, 085	149	98, 558
Leaded zinc oxide	11, 177	-------	3, 087	14, 264	11, 428	-------	160	11, 588
Lithopone	[1] 28, 707	15	12, 871	[1] 41, 593	[1] 20, 546	-------	14, 679	[1] 35, 225
Zinc chloride	-------	5	9, 871	9, 876	-------	5	6, 532	6, 537
Zinc sulphate	957	-------	894	1, 851	1, 263	-------	784	2, 047
	[2] 138, 104	39, 620	[2] 26, 795	[2] 204, 519	104, 561	27, 090	22, 304	153, 955

[1] Includes zinc content of a small quantity of zinc sulphide produced.

[2] Revised figures.

PREPARATION AND USES

WHITE LEAD

White lead is the basic carbonate of lead and is the oldest and most important of the white pigments used in oil paint. The properties of white lead that contribute to its usefulness in paint are its very great hiding power and the facility with which white-lead paint can be worked with a brush. Owing to its relatively high first cost and the fact that white-lead paints are blackened by compounds containing sulphur, the use of less-expensive zinc oxide and lithopone as paint pigments has increased during recent years and has seriously retarded expansion of the white-lead industry.

The largest part of the white lead manufactured in the United States is produced by the "stack" or old Dutch process, wherein perforated disks of high-grade metallic lead, called "buckles," about 6 inches in diameter, are placed in small clay pots, each of which has a well in the bottom containing dilute acetic acid. These pots are arranged in tiers within a large room. Each tier is covered with boards and a layer of spent tanbark. The lead is corroded to the basic carbonate by the action of acetic acid vapor and CO_2. The CO_2 and the heat necessary to vaporize the acetic acid are produced by the fermentation of the tanbark. The process requires three to four months for completion. The corroded lead buckles are washed, crushed, screened, and ground in water, and the pulp is either dried to form dry white lead or ground with oil without drying to form the oil pigment.

Some white lead is also made by the Carter process and the electrolytic process. In the former, metallic lead is finely divided by a jet of steam and is then treated with dilute acetic acid and carbon dioxide in slowly rotating wooden cylinders. The process is completed in about 12 days. In the electrolytic process a lead anode and an iron cathode are used, each of which has an independent continuous circulation of electrolyte kept separate by a porous diaphragm. The electrolytes are solutions of sodium acetate containing sodium carbonate. The anolyte contains the exact amount of carbonate necessary to precipitate the basic lead carbonate, whereas the catholyte contains a relatively large amount of carbonate. During electrolysis the lead dissolves at the anode surface and is immediately precipitated as the basic carbonate in suspension in the anolyte. At the same time CO_3 is generated at the cathode, passes through the diaphragm, and replaces the CO_3 precipitated with the lead, thus maintaining the anolyte at a constant concentration. The catholyte passes through a carbon dioxide absorption tower where it is restored to its original strength. The basic lead carbonate is filtered from the anolyte, washed, dried, pulverized, and barreled.

The principal use of white lead is in the manufacture of paint. It is the only important white pigment that is used unmixed with other pigments in oil paints; it is also used in varying proportions in many mixed pigments. White lead is furnished to the paint trade as dry pigment, as "paste in oil" containing about 8 per cent linseed oil, or as "semipaste in oil" containing 12 to 15 per cent linseed oil. About three-fourths of the white lead produced in the United States is ground in oil. Dry white lead is also used as a constituent of the glaze used in the finer grades of pottery, and some is used in the manufacture of rubber.

The following table shows the sales of white lead (dry and in oil) to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of white lead (dry and in oil) sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Paint	136,526	92.8	91,563	89.6
Ceramics	4,246	2.9	3,366	3.3
Other	6,259	4.3	7,211	7.1
	147,031	100.0	102,140	100.0

The United States exports about 6,000 tons of white lead annually, most of which is manufactured in bond from foreign lead.

BASIC LEAD SULPHATE

Basic lead sulphate is also known as sublimed lead and is marketed in two forms, "white" and "blue."

The white variety is usually made by vaporizing powdered galena at a high temperature in the presence of air, which oxidizes it to the basic sulphate. The resultant fume is collected in bags, and owing to the zinc content of the ore used it usually contains about 5 per cent of zinc oxide. This product is usually not as white as basic carbonate white lead, but has a more stable color in the presence of sulphur gases. Sublimed white lead is also made directly from pig lead. The molten metal is blown through an atomizing nozzle into a heated furnace, and at the same time free oxygen and sulphur dioxide are introduced. The lead is vaporized, oxidized, and converted into basic lead sulphate or lead sulphate in quantity proportionate to the oxygen and sulphur dioxide introduced into the furnace. The resultant fume is collected in settling chambers. It is claimed that this product is the whitest of the lead pigments. Sublimed white lead is used chiefly in the manufacture of prepared paints and mixed pigments. It is also used in the manufacture of storage-battery plates and rubber.

The blue variety is generally a by-product of the smelting of pig lead and is collected from the fumes leaving the smelting furnaces. Its color is due to small amounts of carbon and lead sulphide. Paints made from blue lead are especially useful as protective coatings on metallic surfaces. Some blue lead is also used in the manufacture of rubber.

The following table shows the sales of basic lead sulphate to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of basic lead sulphate sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Paints	13, 435	79. 9	9, 573	83. 0
Storage batteries	2, 327	13. 8	1, 104	9. 6
Rubber	655	3. 9	394	3. 4
Other	397	2. 4	456	4. 0
	16, 814	100. 0	11, 527	100. 0

LITHARGE

Litharge is the monoxide of lead and when pure contains roughly 93 per cent of lead and 7 per cent of oxygen. Commercial litharge usually contains some red lead (Pb_3O_4). Litharge is made by oxidizing pig lead with air at moderate temperatures in reverberatory or cupel furnaces. Powdered litharge is usually produced in the reverberatory furnace, whereas flake litharge is produced in the cupel furnace. Flake litharge is sometimes ground into powdered litharge.

The texture and color of the litharge, which affect its use in the various industries, are controlled by the temperature of the furnace and the method of cooling.

The chief use of litharge is in the manufacture of storage-battery plates. The negative plates are usually made of straight litharge, whereas the positive plates are a mixture of red lead and litharge. The next largest use of litharge is in the oil-refining industry, where it is used to remove objectionable sulphur compounds from gasoline.

More than 12,000 tons of litharge was so used in 1930. A process [3] for the regeneration of the litharge used in oil refining was developed recently.

Litharge acts as a toughener and cure accelerator in the manufacture of mechanical rubber goods and rubber clothing. It is also used in the manufacture of lead chromate color pigment, insecticides, pottery, enamel ware, and glass, and as a drier in the manufacture of varnish and linoleum.

The following table shows the sales of litharge to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of litharge sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Storage batteries	37, 160	42. 2	33, 173	45. 7
Oil refining	13, 615	15. 5	12, 028	16. 6
Rubber	6, 651	7. 6	4, 736	6. 5
Ceramics	8, 663	9. 8	4, 089	5. 6
Chrome pigments	8, 112	9. 2	3, 286	4. 5
Varnish	3, 124	3. 6	698	1. 0
Linoleum	322	. 4	388	. 5
Other	10, 269	11. 7	[1]14, 180	19. 6
	87, 916	100. 0	72, 578	100. 0

[1] Of this quantity about 6,000 tons was reported sold for use as insecticides. Quantity so used in 1929 was not separately reported.

RED LEAD

Red lead is the tetroxide of lead (Pb_3O_4) and is made by heating powdered litharge at a moderate temperature in a "coloring oven." Pure red lead contains about 91 per cent of lead. Commercial forms contain from 70 to 98 per cent of red lead, the remainder being largely litharge which is unchanged in the process of manufacture. The principal use of red lead is in the manufacture of storage batteries where, mixed with litharge, it usually forms the positive plate of the battery. It is an important pigment in paints used as a protective coating on metal surfaces and accounts for the familiar orange color seen on practically all steel construction. A recent development in underground pipe lines is the use of a baked red lead priming coat under asphaltic or bituminous protective coatings. Red lead is the most important of the lead compounds used in the production of flint and optical glass. It is also used in potter's glaze and in enamel ware and as a drier in the manufacture of varnish.

The following table shows the sales of red lead to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of red lead sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Storage batteries	25, 689	59. 7	18, 998	57. 7
Paints	11, 855	27. 6	10, 906	33. 1
Ceramics	903	2. 1	835	2. 5
Other	4, 574	10. 6	2, 202	6. 7
	43, 021	100. 0	32, 941	100. 0

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[3] Chemical and Metallurgical Engineering, Regenerating Litharge for Sodium Plumbite Doctor: Vol. 38, No. 2, February, 1931, p. 76.

ORANGE MINERAL

Orange mineral is a form of red lead; it has the same chemical composition but differs in physical properties and has a lower specific gravity and lighter color. It is usually made by roasting white lead by a process that requires great care and skill. Consequently, the price is higher than that for any of the other lead pigments. Orange mineral is used chiefly in the manufacture of an artificial vermilion color pigment known as eosin lake; it is also used in the production of printer's inks and enamels.

The following table shows the sales of orange mineral to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of orange mineral sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Color pigments	487	71.8	188	52.8
Ink manufacture	151	22.3	88	24.7
Other	40	5.9	80	22.5
	678	100.0	356	100.0

ZINC OXIDE

Zinc oxide, the monoxide of zinc, is made in the United States by two processes—the French and the American. In the former, metallic zinc is heated in a current of air and the resultant oxide fume is collected in long chambers. The product is graded according to its fineness and is labeled "white seal," "green seal," or "red seal." The white-seal variety is the finest and whitest grade. Its specific gravity is much lower than those of the coarser grades. It is used chiefly in high-grade enamel paints. Green seal and red seal are the intermediate and heavy grades, respectively.

American process zinc oxide is made by heating a mixture of zinc ore and anthracite to produce a metallic zinc vapor, which in turn is treated with air to form the oxide. The oxide fume is collected in bag houses. As lead is usually present in the ore the resultant oxide contains some lead compounds. It is usually not quite as white as French oxide but in other respects is very similar. The American process for making zinc oxide predominates in the United States.

Zinc oxide has been used as a paint pigment to a moderate extent for several centuries, but the increase in production in the United States during the twentieth century has been due mainly to the growth of the rubber industry. No recent data on the consumption of zinc oxide by industries are available, but in 1926 it was estimated that the rubber industry consumed more than half of the zinc oxide produced in the United States. Zinc oxide increases the tensile strength of rubber and its resistance to abrasion and tear. It improves the aging qualities by counteracting the tendency of rubber goods to deteriorate under action of light and heat. All of these properties are essential in making automobile tires, tubes, and accessories, which represent about 75 per cent of the entire rubber industry.

Zinc oxide is seldom used alone as a paint pigment, as it dries to a hard, smooth surface which on aging tends to crack and peel off, leaving an unsatisfactory surface for repainting. It has a more stable color and costs less than white lead, has excellent white color and covering properties, and is durable. These many advantages make zinc oxide a useful constituent of mixed paints, in which it finds a large usage. It is generally mixed with lithopone, white lead, and inert pigments.

Zinc oxide is also used in the manufacture of oilcloth and linoleum, pottery glazes and glass, celluloid, druggists' supplies, printer's inks, and leather finishes and for many other purposes.

The use of zinc oxide as a lubricant was reported [4] in 1929. A mixture of zinc oxide and oil in equal parts is said to prevent corrosion of bearings and to improve the bearing surface by depositing thereon a thin film of zinc.

Exports of zinc oxide in 1930 amounted to 9 per cent of the total production.

LEADED ZINC OXIDE

Leaded zinc oxide is made by a method similar to the American process of making zinc oxide. The ore used contains lead in varying proportions, and the finished product may contain from 5 to 35 per cent of basic lead sulphate. The properties of this pigment are similar to those of zinc oxide and basic lead sulphate. It has fair hiding power but is not so white as American process zinc oxide. Leaded zinc oxide is used chiefly in the manufacture of paint. Mixed with lithopone it is said to produce a good exterior paint.

LITHOPONE

Lithopone is the newest of the important white pigments, and its introduction into the United States dates back to the close of the nineteenth century. It contains about 70 per cent of barium sulphate and about 30 per cent of zinc sulphide. The latter, a powerful pigment, is responsible for the useful pigment qualities of lithopone. The process of manufacture consists in mixing proper proportions of solutions of barium sulphide and zinc sulphate. The resultant precipitate is heated to a red heat and plunged into cold water, after which it is ground, dried, and powdered.

The use of high-strength lithopone, containing above 30 per cent of zinc sulphide, has been increasing in recent years. This product can be made directly or by mixing zinc sulphide with ordinary lithopone. The increase in imports of zinc sulphide from less than 4 short tons in 1926 to more than 315 tons in 1929 was probably due to the increased manufacture of high-strength lithopone. This pigment is said to possess very high hiding power and nonsettling properties which make it particularly suitable for the manufacture of shelf goods.

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[4] Chemistry and Industry, vol. 48, Nov. 22, 1929, p. 1136.

The use of lithopone in the United States has increased rapidly and has spread to many industries. Its chief use is in paint manufacture, in which it is favored on account of its low cost and many good qualities. Formerly the use of lithopone was confined to interior paint, as the pigment would discolor in sunlight. In recent years, however, the refining process has been changed, and it is claimed that lithopone with a stable color suitable for exterior paints is now being produced. It is generally mixed with other pigments, notably zinc oxide.

A large quantity of lithopone is used in the manufacture of oilcloth and linoleum, artificial leather finishes, window shades, and printer's inks.

Imports of lithopone into the United States in 1930 amounted to 7,018 short tons, or the equivalent of 4 per cent of the domestic sales. Exports amounted to 3,665 tons.

The following table shows the sales of lithopone to various industries in 1929 and 1930, as reported to the Bureau of Mines by the producers.

Distribution of lithopone sales, 1929 and 1930, by industries

Industry	1929		1930	
	Short tons	Per cent of total	Short tons	Per cent of total
Paints, varnish, and lacquers	150, 804	73. 1	126, 076	76. 8
Floor coverings and textiles	37, 506	18. 2	23, 656	14. 4
Rubber	7, 176	3. 5	5, 997	3. 7
Other	10, 829	5. 2	8, 336	5. 1
	206, 315	100. 0	164, 065	100. 0

ZINC SALTS

Zinc sulphate, sometimes known as white vitriol, is usually made by treating secondary zinc material with dilute sulphuric acid, which upon evaporation yields the white crystalline salt. One of the principal uses of zinc sulphate is as a depressing reagent in the flotation of lead-zinc ores. It has recently been used as a weed killer in the tree nurseries of the United States Forestry Service. It is also used in the solutions of electro-galvanizing cells, to some extent in calico printing and in dyeing, as a drier for linseed oil, as a disinfectant and astringent, and as a sizing on cement prior to painting. In addition to these uses, several thousand tons is used yearly in the manufacture of lithopone; as this sulphate represents an intermediate product it is not separately recorded by the Bureau of Mines.

Zinc chloride may be prepared by treating zinc directly with chlorine or with hydrochloric acid, the latter being more generally used. Practically all zinc chloride produced in the United States is made from scrap metal or secondary materials, such as drosses, ashes, skimmings, and galvanizer's scrap. Owing to its hygroscopic properties it is usually marketed in solution, although the fused salt may be obtained in air-tight containers. Zinc chloride is used chiefly as a preservative of timber. It is also used as a germicide and disinfectant, in the refining of petroleum, in the textile industry, in the manufacture of hard fiber, for medical purposes, and in dentistry.

A new wood preservative, zinc meta-arsenite, $Zn(AsO_2)_2$, has recently been developed and according to reports is being used in increasing amounts, particularly where large quantities of moisture are encountered. The chemical is insoluble in water and does not have the disagreeable properties of creosote, such as odor, color, fire risk, and unpaintability.

PRODUCERS AND PLANTS

The following companies reported having sold or used lead and zinc pigments and zinc salts of their own production in 1930.

White lead:	
Anaconda Lead Products Co. (electrolytic process)	East Chicago, Ind.
Carter White Lead Co	West Pullman, Chicago, Ill.
Eagle-Picher Lead Co	East St. Louis, Ill.
Do	Cincinnati, Ohio.
Euston Lead Co	Scranton, Pa.
W. P. Fuller & Co	South San Francisco, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
National Lead Co	Chicago, Ill.
Do	St. Louis, Mo.
Do	Perth Amboy, N. J.
Do	Brooklyn, N. Y.
Do	Port Richmond, N. Y.
Do	Cincinnati, Ohio.
National Lead Co. of California	Melrose, Calif.
National Lead & Oil Co. of Pennsylvania	New Kensington, Pa.
Sherwin-Williams Co	Chicago, Ill.
Wetherill & Bro	Philadelphia, Pa.
Basic lead sulphate, or sublimed lead:	
Eagle-Picher Lead Co	Joplin, Mo.
Eagle-Picher Mining & Smelting Co	Galena, Kans.
St. Louis Smelting & Refining Works of National Lead Co	Collinsville, Ill.
Red lead, orange mineral, and litharge:	
Eagle-Picher Lead Co	East St. Louis, Ill.
Do	Joplin, Mo.
Do	Newark, N. J.
Do	Cincinnati, Ohio.
Evans Lead Co	Charleston, W. Va.
Franklin Lead Oxide Co	Franklin, Pa.
W. P. Fuller & Co	South San Francisco, Calif.
Grasselli Chemical Co	East Chicago, Ind.
Morris P. Kirk & Son	Los Angeles, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
Metals Refining Co	Hammond, Ind.
National Lead Co. of California	Melrose, Calif.
National Lead Co	Chicago, Ill.
Do	St. Louis, Mo.
Do	Brooklyn, N. Y.
National Lead & Oil Co. of Pennsylvania	New Kensington, Pa.
Sherwin-Williams Co	Chicago, Ill.
Zinc oxide and leaded zinc oxide:	
American Zinc Co. of Illinois	Hillsboro, Ill.
American Zinc Oxide Co	Columbus, Ohio.
Eagle-Picher Lead Co	Hillsboro, Ill.
Empire Zinc Co	Canon City, Colo.
Grasselli Chemical Co	East Chicago, Ind.
International Lead Refining Co. (French process)	Do.
Do	Akron, Ohio.
Mineral Point Zinc Co	Mineral Point, Wis.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
Do. (French process)	Freemansburg, Pa.
Ozark Smelting & Mining Co	Coffeyville, Kans.
St. Joseph Lead Co	Herculaneum, Mo.

Lithopone:	
Chemical & Pigment Co. (Inc.)	Oakland, Calif.
Do	Collinsville, Ill.
Do	St. Helena, Md.
Eagle-Picher Lead Co	Argo, Ill.
Grasselli Chemical Co	Grasselli, N. J.
Do	Newark, N. J.
Do	Philadelphia, Pa.
Krebs Pigment & Chemical Co	Newport, Del.
Mineral Point Zinc Co	Depue, Ill.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
Sherwin-Williams Co	Chicago, Ill.
United Color & Pigment Co	Newark, N. J.
Zinc salts:	
American Smelting & Refining Co	Selby, Calif.
Do	Durango, Colo.
Do	Omaha, Nebr.
Do	Perth Amboy, N. J.
Arkansas Preservative Co	North Little Rock, Ark.
Charles Cooper & Co	Newark, N. J.
General Chemical Co	Chicago, Ill.
Grasselli Chemical Co	East Chicago, Ind.
Do	Cleveland, Ohio.
Do	Weirton, W. Va.
Harshaw Chemical Co	Cleveland, Ohio.
Charles Lennig & Co. (Inc.)	Philadelphia, Pa.
Merrimac Chemical Co	Everett, Mass.
Ozark Smelting & Mining Co	Coffeyville, Kans.

During 1930 the St. Joseph Lead Co., at Rochester, Pa., completed a new zinc oxide plant in which zinc sulphide concentrates are converted into the oxide by a new electrothermic process. The plant has a capacity of 120 tons of concentrates daily, and the first furnace was put into operation early in 1931. The by-product, sulphur dioxide gas, is converted into sulphuric acid by the contact process. Zinc oxide was produced during 1930 at the experimental plant of the company at Herculaneum, Mo.; this plant was closed toward the end of the year.

Morris P. Kirk & Son (Inc.), control of which was acquired by the National Lead Co., began producing lead oxides in 1930 at Los Angeles, Calif. The lead oxide plant and assets (at Charleston, W. Va.) of the Evans-Wallower Lead Co. of St. Louis, Mo., were also purchased by the National Lead Co. during 1930.

The lead smelter and sublimed lead plant of the Eagle-Picher Lead Co. at Galena, Kans., were acquired in 1930 by the newly created subsidiary, the Eagle-Picher Mining & Smelting Co.

TARIFF

The tariff act of 1930 became effective June 18, 1930. The only changes in the schedules on lead and zinc pigments and salts were an increase from 1½ cents to 3 cents per pound on zinc sulphide, and an increase from 1¾ cents per pound to 1¾ cents per pound plus 15 per cent ad valorem on lithopone containing by weight 30 per cent or more of zinc sulphide. The rates on lead and zinc pigments and salts provided in the 1930 act are shown in the following statement.

Import duties on lead and zinc pigments and salts under the tariff act of 1930

Paragraph	Item	Import duty
72	Lead pigments:	
	Litharge	2½ cents per pound.
	Orange mineral	3 cents per pound.
	Red lead	2¾ cents per pound.
	White lead	2½ cents per pound.
	All pigments containing lead, dry or in pulp, or ground in or mixed with oil or water, not specially provided for	30 per cent ad valorem.
46	Lead chemicals:	
	Acetate, white	2½ cents per pound.
	Acetate, brown, gray, or yellow	2 cents per pound.
	Nitrate, arsenate, and resinate	3 cents per pound.
	All other lead compounds, n. s. p. f.	30 per cent ad valorem.
77	Zinc pigments:	
	Zinc oxide and leaded zinc oxide containing not more than 25 per cent of lead—	
	Dry powder	1¾ cents per pound.
	Ground in or mixed with oil or water	2¼ cents per pound.
	Lithopone, and other combinations or mixtures of zinc sulphide and barium sulphate containing by weight—	
	Less than 30 per cent of zinc sulphide	1¾ cents per pound.
	30 per cent or more of zinc sulphide	1¾ cents per pound and 15 per cent ad valorem.
93	Zinc chemicals:	
	Zinc chloride	$1\frac{3}{10}$ cents per pound.
	Zinc sulphate	¾ of 1 cent per pound.
	Zinc sulphide	3 cents per pound.

IMPORTS AND EXPORTS

LEAD PIGMENTS

Imports of lead pigments into the United States are relatively unimportant. Exports of white lead pigments increased 11 per cent in 1930 and amounted to 6 per cent of the total sales of domestic white lead; exports to the United Kingdom increased 40 per cent and amounted to 73 per cent of the total. Combined exports of red lead, litharge, and orange mineral increased 43 per cent in 1930 and amounted to 4 per cent of the total sales by domestic manufacturers. Exports of these three pigments to Canada, Netherland West Indies, and the United Kingdom amounted to 39, 22, and 11 per cent of the total, respectively; exports to Netherland West Indies increased nearly 700 tons, or 325 per cent; those to the United Kingdom and Canada increased 162 and 4 per cent, respectively.

Basic carbonate white lead, red lead, litharge, and orange mineral imported for consumption in the United States, 1921–1930

Year	Basic carbonate white lead		Red lead		Litharge		Orange mineral	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	124, 176	$12, 598	12, 236	$689	100	$7	77, 937	$7, 830
1922	222, 465	21, 335	1, 405	94	1, 770	162	111, 419	9, 729
1923	336, 892	31, 386	3, 600	220	22, 525	1, 314	116, 293	9, 031
1924	141, 156	13, 478	1, 874	155	1, 838	193	99, 341	8, 047
1925	213, 028	21, 535	3, 452	268	2, 417	330	58, 522	6, 278
1926	297, 567	31, 690	9, 591	817	122	13	58, 104	5, 143
1927	330, 421	29, 901	51, 688	4, 403	1, 182	133	44, 866	3, 816
1928	166, 236	15, 889	24, 675	1, 510	2, 100	153	62, 409	5, 227
1929	196, 478	19, 086	10, 197	745	3, 763	270	52, 122	3, 889
1930	147, 132	13, 496	19, 116	1, 334	968	90	25, 338	1, 955

White lead and red lead exported from the United States, 1921–1930

Year	White lead[1]		Red lead[2]	
	Short tons	Value	Short tons	Value
1921	5,161	$993,130	548	$115,500
1922	4,598	710,765	1,683	294,133
1923	[1] 5,172	836,261	[2] 1,840	372,828
1924	[1] 5,055	853,444	[2] 940	210,598
1925	[1] 6,832	1,293,168	802	183,591
1926	[1] 6,239	1,119,350	775	175,273
1927	[1] 6,047	947,226	[2] 1,429	271,376
1928	[1] 6,476	952,316	[2] 2,084	364,995
1929	[1] 5,908	921,509	[2] 2,890	503,243
1930	[1] 6,546	923,281	[2] 4,128	590,285

[1] Exports of white lead and basic lead sulphate or sublimed lead not classified separately after 1922; the figures for 1923–1930 may include an unknown quantity of basic lead sulphate or sublimed lead.

[2] Exports of red lead and litharge not classified separately for 1923–1924 and 1927–1930; the figures for those years may include an unknown quantity of litharge; the figures for 1928–1930 include also an unknown quantity of orange mineral. Figures for other years are for red lead only.

White lead[1] exported from the United States, 1929 and 1930, by destinations

Destination	1929		1930	
	Short tons	Value	Short tons	Value
North America:				
Canada	122	$19,807	66	$10,008
Cuba	58	10,207	67	9,404
Mexico	127	28,776	98	21,041
Panama	568	117,561	101	16,809
Other	65	13,588	56	11,879
	940	189,939	388	69,141
South America:				
Argentina	400	65,413	434	67,890
Brazil	12	2,231	33	4,558
Colombia	18	4,206	3	702
Uruguay	32	5,089	43	6,727
Venezuela	19	4,213	11	2,406
Other	15	2,648	51	7,565
	496	83,800	575	89,848
Europe:				
Netherlands	532	66,715	257	29,664
United Kingdom	3,382	482,627	4,750	632,059
Other	23	4,656	68	9,208
	3,937	553,998	5,075	670,931
Asia:				
Philippine Islands	228	47,912	380	74,154
Other	266	37,948	104	14,713
	494	85,860	484	88,867
Africa	5	744	8	1,009
Oceania, including Australia	36	7,168	16	3,485
	5,908	921,509	6,546	923,281

[1] Exports of white lead and basic lead sulphate or sublimed lead not classified separately after 1922; the figures may include an unknown quantity of basic lead sulphate or sublimed lead.

ZINC PIGMENTS AND SALTS

Imports of lithopone, the principal zinc pigment imported into the United States, decreased 17 per cent in 1930 and were equivalent to 4 per cent of the domestic sales. Imports of zinc oxide declined 18 per cent and were equivalent to less than 1 per cent of the domestic production. Imports of zinc sulphide, which increased rapidly from 1926 to 1929, declined 75 per cent in 1930. Nearly all the zinc pigments imported in 1930 came from Europe. Belgium supplied 60 per cent, France 20 per cent, and the United Kingdom 10 per cent of the zinc oxide; the Netherlands supplied 86 per cent and Belgium 8 per cent of the lithopone; and Germany supplied 98 per cent of the zinc sulphide. The United Kingdom and Canada took 44 and 42 per cent, respectively, of the zinc oxide exported in 1930; Canada also took 88 per cent of the lithopone exported.

Zinc oxide, lithopone, zinc sulphide (white), zinc chloride, and zinc sulphate imported for consumption in the United States, 1921–1930

Year	Zinc oxide				Lithopone	
	Dry		In oil			
	Short tons	Value	Short tons	Value	Short tons	Value
1921	1,286	$145,071	57	$17,549	5,247	$432,019
1922	2,712	361,599	42	8,595	10,763	885,671
1923	1,036	169,415	89	21,934	10,440	776,383
1924	1,703	229,629	110	25,874	6,830	543,025
1925	1,274	205,582	132	31,187	6,330	478,395
1926	1,127	198,897	94	23,163	8,686	661,700
1927	1,399	220,427	77	18,619	7,979	656,166
1928	1,348	208,557	107	25,620	9,885	808,200
1929	1,267	203,080	110	27,145	8,409	725,554
1930	1,056	148,891	79	16,614	7,018	595,597

Year	Zinc sulphide [1]		Zinc chloride		Zinc sulphate	
	Pounds [1]	Value	Short tons	Value	Short tons	Value
1921	93,537	$8,330	2,199	$213,995	17	$820
1922	27,159	8,453	1,374	87,509	17	1,064
1923	11,844	5,403	551	44,164	20	3,466
1924	9,678	5,727	319	28,911	13	1,265
1925	14,604	5,589	469	50,712	17	1,368
1926	7,800	4,125	568	51,605	66	4,590
1927	132,223	22,984	470	40,069	205	9,390
1928	338,030	47,235	563	47,185	683	28,866
1929	630,565	84,260	638	50,324	909	32,127
1930	159,533	23,552	351	28,811	519	17,819

[1] Zinc sulphide is stated in pounds rather than tons because of its high value and smaller quantities.

Zinc oxide and lithopone exported from the United States, 1921–1930

Year	Zinc oxide		Lithopone	
	Short tons	Value	Short tons	Value
1921	2,511	$426,253	(1)	(1)
1922	3,977	593,128	1,616	$169,982
1923	5,024	743,577	1,485	176,624
1924	3,927	605,630	923	104,783
1925	10,855	1,503,561	1,287	132,771
1926	14,661	1,917,420	1,941	200,412
1927	14,494	1,821,786	2,110	222,585
1928	14,799	1,849,889	3,326	337,565
1929	17,638	2,301,643	4,556	463,235
1930	10,753	1,446,904	3,665	380,047

(1) Not classified separately prior to 1922.

Zinc oxide exported from the United States, 1929 and 1930, by destinations

Destination	1929		1930	
	Short tons	Value	Short tons	Value
North America:				
Canada	7, 702	$1, 062, 618	4, 547	$628, 178
Cuba	117	17, 508	91	13, 960
Mexico	73	13, 448	20	4, 314
Panama	87	15, 486	101	18, 637
Other	18	4, 483	53	8, 016
	7, 997	1, 113, 543	4, 812	673, 105
South America:				
Argentina	24	4, 799	68	12, 066
Brazil	5	1, 129	9	1, 928
Other	40	8, 931	28	6. 381
	69	14, 859	105	20, 375
Europe:				
France	452	50, 836	428	52. 375
Italy	69	11, 361	115	16, 651
United Kingdom	6, 360	762, 010	4, 719	578, 829
Other	1, 144	125, 964	116	18, 024
	8, 025	950, 171	5, 378	665, 879
Asia:				
Philippine Islands	88	12, 264	69	8, 729
Other	819	110, 415	107	20, 244
	907	122, 679	176	28, 973
Africa	3	594	14	3. 406
Oceania, including Australia	637	99, 797	268	55, 166
	17, 638	2, 301, 643	10, 753	1, 446, 904

PRICES AND VALUE

The total value and the average price received by producers from sales of lead and zinc pigments and salts are given on preceding pages of this chapter. The range of market quotations as reported by the Oil, Paint and Drug Reporter is shown in the following table.

Range of quotations on lead pigments and zinc pigments and salts at New York, 1928–1930, in cents per pound

Product	1928	1929	1930
Basic lead sulphate, or sublimed lead, dry, casks	7. 75	7. 75– 8. 50	6. 75– 7. 75
White lead, or basic lead carbonate:			
Dry, casks	8. 25– 8. 50	8. 25– 9. 00	7. 25– 8. 25
In oil, carload lots	10. 73	10. 73–11. 54	10. 69–11. 54
Litharge, American, commercial, powdered, casks	8. 50– 9. 00	8. 75–10. 25	7. 75– 8. 75
Red lead, dry, casks	9. 50–10. 00	9. 75–11. 25	8. 75– 9. 75
Orange mineral, American, casks	11. 50–12. 00	11. 75–13. 25	10. 75–11. 75
Lead acetate, brown, broken, barrels	12. 00–12. 50	12. 00–13. 50	10. 50–13. 00
Lead arsenate, powdered, drums	13. 00–15. 00	13. 00–15. 00	13. 00–16. 00
Zinc oxide:			
American process, lead-free, bags, car lots	6. 50	6. 50	6. 50
American process, leaded, barrels, car lots	6. 88	6. 88	6. 88
French process, red seal, bags, car lots	9. 38	9. 38	9. 38
French process, green seal, bags, car lots	10. 38	10. 38	10. 38
French process, white seal, barrels, car lots	11. 63	11. 63	11. 63
Lithopone, American, bags, car lots	5. 25	5. 25	4. 50– 5. 25
Zinc chloride:			
Solution,[1] drums	2. 75– 3. 25	2. 75– 3. 25	2. 25– 3. 50
Fused	5. 25	5. 25– 5. 75	5. 75
Zinc sulphate, barrels	3. 50– 3. 75	3. 00– 3. 75	3. 00– 3. 50

[1] At works.

Quotations on each of the lead pigments declined about 1 cent per pound during 1930 as a result of the decrease in the price of pig lead (New York) from 6.25 cents at the beginning of the year to 5.1 cents at the end; the trend of prices was downward throughout the year. In April producers of lead pigments increased the trade discounts to provide a larger margin of profit to dealers and probably to provide incentive to dealers to push the sale of lead pigments, particularly white lead.

Quotations in 1930 on the various grades of zinc oxide were maintained at the level of the three preceding years, although the price of zinc (St. Louis) declined from 5.45 cents at the beginning of 1930 to 4.12½ cents at the end. The average price of zinc oxide per ton, received by producers reporting to the Bureau of Mines, decreased from $128 in 1929 to $125 in 1930, due probably to a relatively greater production of the cheaper grades of zinc oxide in 1930. The quotation for ordinary lithopone was maintained at 5¼ cents per pound for 11 months of the year, but in December it dropped to 4½ cents following a cut in the price of titanium pigment. The average price for lithopone per ton, received by domestic producers, was $97 in 1930 as compared with $96 in 1929. This increase, in contrast to the decrease in quotations, may have been due to a greater production of the higher priced high-strength lithopone.

VANADIUM, URANIUM, AND RADIUM[1]

By Frank L. Hess[2]

CONTENTS

	Page
Vanadium	133
General conditions	133
Domestic production	133
Imports	134
World production	134
Peru	135
Africa	135
Uses	139
Legislation	139
Prices	139
Uranium and radium	140
Production in the United States	140
Uranium and radium—Continued.	
Imports	140
Production in foreign countries	140
Belgian Congo	140
Czechoslovakia	141
Canada	141
Uses	141
Quantity of radium in United States	142
Legislation	142
Metallurgy	143
Prices	144
Bibliography	144

ILLUSTRATION

Figure 1.—Origin and shipment of vanadium ore from Peru. Reproduced from Vancoram Review, January, 1930 ... 136

VANADIUM

GENERAL CONDITIONS

The vanadium trade of the world in 1930 remained very much as it had been during the last half decade. As in preceding years, production was practically confined to the ores from Minasragra, Peru; the oxidized metallic minerals from Broken Hill, Northern Rhodesia, and from the vicinity of Otavi, South-West Africa; and the roscoelite and related minerals of western Colorado and southeastern Utah.

No figures for production can be given for the United States, due to interrelationships between companies.

DOMESTIC PRODUCTION

The United States Vanadium Corporation, a subsidiary of the Electro Metallurgical Co., New York, continued operations at its mine on East Rifle Creek, 11 miles from Rifle, Colo., where the milling plant is located. A fused vanadium oxide containing 86 to 90 per cent V_2O_5 is made and shipped to the Electro Metallurgical Co.'s eastern plants for reduction to ferrovanadium.

The International Vanadium Corporation operated under W. C. Paterson in Dry Valley about 55 miles southeast of Moab, Utah, and about 85 miles from Thompsons, the nearest accessible railroad point. The ore used contains some carnotite but more of the uranium-free vanadium minerals distributed through the McElmo sandstone in such fine division as to be very difficult of determination. These minerals include roscoelite (vanadium mica) or a closely related mineral.

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[1] Work on manuscript completed July, 1931.

[2] Statistics on domestic production prepared by H. W. Davis, of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

vanoxite ($2V_2O_4.V_2O_5.8H_2O$), hewettite ($CaO.3V_2O_5.9H_2O$), and others.

As indicated by the name of the valley, water is scarce and is obtained from wells about 600 feet deep. Fused vanadium oxide carrying 80 to 93 per cent V_2O_5 was produced, but only a little was marketed.

On the San Miguel River below Long Park and 3 miles from Naturita, Colo., the Rare Metals Corporation erected a mill for the reduction of vanadium oxide from ores qualitatively similar to the ores of Dry Valley, Utah, but richer in both vanadium and uranium. The mill was built with a capacity of 50 tons of ore per day but is said to have actually handled as much as 65 tons per day. Land with a coal bed 5 feet thick was obtained on a mesa above the mill, and the coal was delivered to the mill by aerial tram. Wells in Paradox Valley 20 miles from the mill gave brine carrying 25 per cent of salt at depths of 5 to 8 feet, and claims containing pyrite were leased at Vanadium (about 60 miles east by road).

The ores were obtained from claims of the Vanadium Corporation of America and were estimated to average 2.48 per cent V_2O_5 and 0.5 per cent U_3O_8. It was proposed to save the uranium-bearing slimes and recover both uranium and radium.

The mill started July 8, 1930, and was closed August 8. The shutdown was said to be due to a bad water supply and consequent boiler troubles. Financial difficulties kept the plant closed.

In Arizona the United Vanadium Corporation operated the Bywater vanadinite deposit at Dripping Springs 10 or 12 miles west of Christmas and 20 miles or more directly south of Globe. One lot of concentrates said to carry 15 per cent V_2O_5 was shipped to Europe. The deposit is a stockwork in an altered andesite in which the surfaces of fragments of the lava have a thin coating of vanadinite crystals.

IMPORTS

Vanadium ore imported into the United States comes practically only from Peru from the great deposit at Minasragra, although a few years ago ores were imported from South Africa. The imports from Peru average about 12 per cent vanadium.

Imports of vanadium ores from all sources during the past 10 years are shown in the following table:

Vanadium ore (steel-hardening) imported for consumption in the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	10,307,540	$543,061	1926	16,735,040	$914,114
1922	611,170	86,776	1927	13,885,760	561,051
1923	4,177,115	229,210	1928	1,104,320	49,771
1924	14,116,596	722,731	1929	19,519,360	794,734
1925	4,735,161	339,468	1930	11,576,320	491,633

WORLD PRODUCTION

The world production of vanadium in ores and concentrates during 1929 and 1930, as indicated by statistics at present available, has been as follows:

World production of vanadium in ores and concentrates, 1929 and 1930

Country	1929		1930	
	Pounds	Value[1]	Pounds	Value[1]
Mexico	1,777	$889	(2)	(2)
Northern Rhodesia	131,290	65,645	122,607	$61,304
Peru	1,989,575	994,788	1,056,293	528,147
South-West Africa	685,504	342,752	1,007,258	503,629
United States	(3)	(3)	(3)	(3)

[1] Value arbitrarily fixed at 50 cents a pound for vanadium contained.
[2] Data not available.
[3] Bureau of Mines not at liberty to publish figures.

Peru.—The vanadium ore from Peru comes entirely from the deposit of the Vanadium Corporation of America at Minasragra and as now shipped is largely mechanically concentrated.

According to estimates by Dr. W. Spencer Hutchinson the ore reserves contain 35,000,000 pounds of probable vanadium and perhaps 35,000,000 pounds of possible vanadium.[3]

The corporation published in the January, 1930, number of Vancoram Review an exaggerated detail map of the Peruvian vanadium deposits which gives so much information concerning this little-known part of the world that it is reproduced on the following page.

Africa.—At the end of 1930 Broken Hill (Rhodesia) Development Co. (Ltd.), which has descloizite and vanadinite in connection with a large zinc deposit at Broken Hill, Northern Rhodesia, had its plant for the production of ferrovanadium in operation. The annual capacity is said to be 570 tons of ferrovanadium containing 34 per cent vanadium.[4] A plant to make vanadium oxide, from which the ferrovanadium is smelted, is said to have a capacity of 600 tons of fused V_2O_5 per year.

The process of reduction of oxide from the ore is said to be as follows.[5]

> The vanadium is precipitated from the zinc solution as a zinc or iron vanadate, or a mixture thereof, which precipitate is subjected to re-treatment for the recovery of the vanadium in a purified form.
>
> The precipitate is removed from the solution by filtration in pressure filter presses, the filtrate being returned to the zinc circuit, and the cake washed with water to remove most of the soluble zinc. When washing is complete, the precipitate is discharged from the press and transported to a storage bin, whence it is fed, together with water, to a grinding mill where the cake is converted to slurry. The mill discharge is pumped to storage tanks, in which agitation is maintained, and from which pulp is withdrawn as required to the first stage of purification, which is a solution of the vanadium in caustic soda. The latter reagent is prepared on the plant by reaction between lime and soda carbonate in the well-known manner and is produced as a caustic liquor containing at least 75 g. p. l. NaOH.
>
> Proportions of vanadate slurry and caustic solution, depending on the relative density and strength, are mixed in an iron tank provided with agitation and means of steam heating. The temperature is raised to nearly 100° C. and agitation is continued until the reaction is complete, approximately 1 to 2 hours. The vanadium dissolves as a sodium vanadate, and the zinc, iron, etc., mostly remain insoluble as hydroxides.
>
> The pulp is then pumped to a filter press, and the purified solution sent on to the next stage of treatment. The residue in the press is washed with water, and then discharged and transported to a pug mixing machine which delivers into an

---

[3] Vancoram Review, vol. 1, April, 1930, p. 71.
[4] Metal Bulletin, London, Oct. 14, 1930, p. 8.
[5] Mining Journal, London, vol. 172, Jan. 24, 1931, pp. 62–63.

agitation tank where the residue is suspended in zinc solution and then pumped back to the zinc circuit for recovery of that metal and utilization of its basicity for further precipitation purposes.

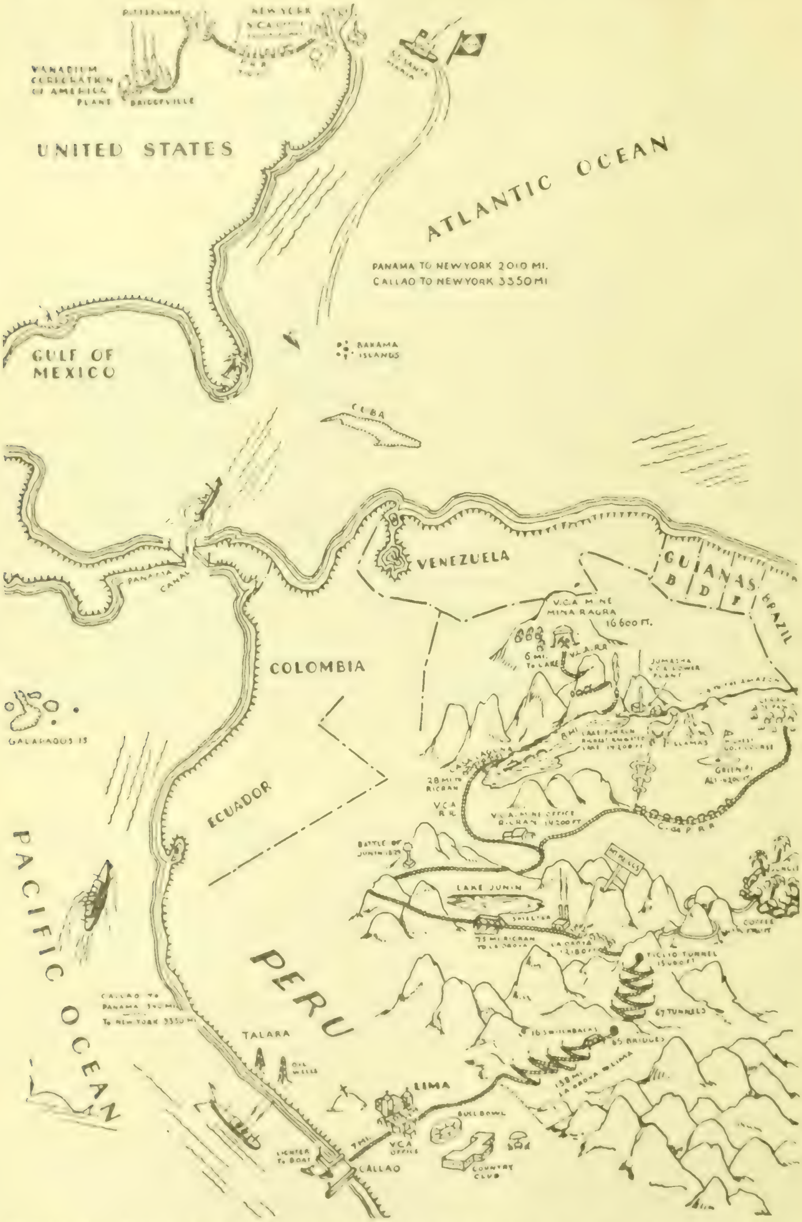
PITTSBURGH
NEW YORK
VANADIUM CORPORATION OF AMERICA PLANT
BRIDGEVILLE
UNITED STATES
ATLANTIC OCEAN
PANAMA TO NEW YORK 2010 MI.
CALLAO TO NEW YORK 3350 MI
GULF OF MEXICO
BAHAMA ISLANDS
CUBA
PANAMA CANAL
VENEZUELA
GUIANAS
B
D
F
BRAZIL
COLOMBIA
GALAPAGOS IS
ECUADOR
V.C.A MINE MINA RAGRA 16600 FT.
6 MI. TO LAKE
V.C.A. R.R.
JUMASHA V.C.A LOWER PLANT
TO AMAZON
8 MI
LLAMAS
28 MI TO RICRAN
V.C.A R.R.
V.C.A. MINE OFFICE RICRAN 14200 FT
C. de P. R.R.
BATTLE OF JUNIN 1824
LAKE JUNIN
SMELTER
75 MI RICRAN TO LA OROYA
LA OROYA 12180 FT
TICLIO TUNNEL 15800 FT
COFFEE FRUIT
JUNGLE
67 TUNNELS
16 SWITCHBACKS
65 BRIDGES
138 MI LA OROYA TO LIMA
PACIFIC OCEAN
PERU
TALARA
OIL WELLS
LIMA
BULL BOWL
V.C.A OFFICE
7 MI.
LIGHTER TO BOAT
CALLAO
COUNTRY CLUB

FIGURE 1.—Origin and shipment of vanadium ore from Peru. Reproduced from Vaucoram Review, January, 1930

The sodium vanadate solution is then sent to the vanadic hydrate precipitation tanks, where sulphuric acid is added until free acidity is about 5 g. p. l. H_2SO_4. Steam is then turned on, and the temperature allowed to rise to a maximum of about 95° C. The solution may be heated prior to addition of acid or acid added during heating, whichever of the three methods is most convenient.

Acid is added from time to time as may be necessary to maintain at least 5 g. p. l. excess, though excess up to 25 g. p. l. can be added without detriment. As the temperature rises, the vanadic hydrate will precipitate, and maximum precipitation will be obtained at boiling point, the final temperature of the solution being such as to give an economic precipitation consistent with the cost of steam heating. Excess of acid generally lowers the precipitation efficiency, but may give a purer product, so the excess acid at which the precipitation is conducted is regulated to be the amount required to produce maximum precipitation at the desired purity. The residual impurities in the solution remain dissolved and the vanadic hydrate is practically pure.

When precipitation has reached the desired standard, the pulp is filter pressed in a wooden framed press. The filtrate is either run to waste or is re-treated for its vanadium content depending on the amount of the latter. Such re-treatment may be simply returning to the zinc circuit at a suitable point if the content of other soluble salts permit, or may be a precipitation with lime, which precipitate would then be re-treated in the causticising step, and the vanadium recovered in the caustic solution during the use of the latter to dissolve the vanadium from the zinc vanadate.

The vanadic hydrate precipitate in the press is then washed till all soluble salts are removed, the wash being used in a countercurrent manner and the strong wash returned to the precipitation circuit, after which the cake is discharged to a bin and then fed to a gas-fired melting furnace, where first the moisture and combined water are drawn off and then the dehydrated material fused. The fused oxide discharges more or less continually into molds, from which it is discharged, crushed, and bagged.

The grade of oxide produced is at least 90 per cent V_2O_5 and may be 95 per cent or better. It is practically free from phosphorus and sulphur, the balance being made up of alkalies with small amounts of silica and iron.

This method of treatment has been developed by the general manager, Mr. R. H. Stevens, who was responsible for the original zinc leaching process, which is now the principal interest of the company.

In 1926 (the latest year for which figures are available) the deposits were calculated to contain 34,000 tons of ore carrying 2 per cent vanadium and 848,000 tons of ore carrying about 0.5 per cent vanadium.

The only other production of vanadium from South Africa is from the Otavi region in South-West Africa.

The principal mines are the Tsumeb mine near Otavi and the Abenab mine.

According to A. W. Clark:[6]

The Abenab deposit is the largest so far discovered in this district and is probably the world's principal producer of vanadium. Discovered in 1921, the mine lies between two small kopjes[7] in the extreme northeast of the mountains about 20 miles north of the railway terminus at Grootfontein, with which it is connected by a good motor road. The dolomites here are steeply inclined towards the north and have been faulted, so that the upper dolomite now rests against the platy limestone, both hanging-wall and foot-wall rock being crushed and brecciated. Surface water circulating within this fracture zone has dissolved out a large pipe-shaped cavity, some 200 by 120 feet at surface, which has gradually become filled with fragments of dolomite, limestone, and chert derived from the roof and walls of the cavity and ranging in size from a fraction of an inch to 2 to 3 feet across, the larger blocks being mainly dolomite. The rock fragments are embedded in red cave limestone in which the ore minerals occur together with considerable amounts of calcite. Several smaller solution cavities carrying vanadium minerals have been found in the vicinity of the main pipe and thin films of descloizite have formed along the bedding planes of the platy limestone on the footwall side of the deposit. The zinc occurrence previously mentioned outcrops about 500 feet south of the mine and can be followed for a distance of about 1,500 feet towards the west. At its western extremity (Abenab West) the carbonate ore carries appreciable quantities of descloizite. Some patches of galena and blende are found in many places in the dolomite to the north and west of the Abenab mine, but no sulphides have been found in the main ore body. Granite underlies the flats to the south, though covered over by secondary lime and red sand.

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[6] Clark, A. W., The Ore Deposits of the Otavi Mountains, South-West Africa: Min. Mag., London, vol. 44, May, 1931, pp. 271–272.

[7] Small hills. Pronounced "copies."

The chief ore mineral at Abenab is descloizite, which occurs in small well-formed orthorhombic crystals in a crystalline aggregate with calcite or in the red filling of the breccia. Below the fourth level, however (at a depth of about 120 feet), a considerable quantity of vanadinite is found in clusters of large prismatic crystals up to 3 to 4 inches long, usually coated with a film of descloizite, sometimes as much as one-sixteenth inch thick.

The mine was opened up by means of an opencast, and an inclined shaft was sunk in the footwall from which the ore body was developed by five main and two intermediate levels at intervals of 30 feet, the ground on each level being blocked out in 30-foot blocks. A main 3-compartment vertical shaft was sunk in the dolomite some 150 feet to the northeast of the opencast to the fifth level at a depth of 180 feet. Ore and waste from the opencast, which has now reached a depth of 150 feet, go through passes to the main drive on the fifth level and are hoisted to surface through the vertical shaft. Recent development includes the deepening of the shaft and the opening up of a new level at a depth of 220 feet, which is about 20 feet below the present ground water level. The ore, which is crushed and concentrated in a dressing plant consisting of Blake crusher, Krupp mills, and Overstrom and James tables, contains slightly over 10 per cent of concentrates averaging 18 to 20 per cent V_2O_5.

The following are typical analyses of concentrates from Abenab and Uris (1926):

	Abenab	Uris		Abenab	Uris
V_2O_5	18.31	18.75	Zn	13.90	4.12
Pb	45.15	45.57	P	.041	.036
Cu	.96	9.99	CaO	3.15	2.26

The average V_2O_5 content of the Abenab concentrates is now over 19 per cent.

Referring to the Tsumeb and other mines Clark says:[8]

> More important economically, however, are the numerous small occurrences of free vanadium ores which have been found at many places throughout the district. At surface the ore is usually found in lumps buried in red sand in potholes or in rubble-filled cavities in the dolomite. Some of these "sand sacks" when worked out show no trace of ore in situ in the dolomite below the sand, but others are found to represent the weathered outcrops of ore-bearing pipes or sink holes containing red cave limestone or dolomite breccia. The ore minerals, descloizite, etc., usually occur filling vugs or interstices in the breccia or encrusting the dolomite fragments or walls of the cavity and are occasionally associated with much secondary calcite. Although traces of galena and blende are frequently observed in the dolomite country rock in the vicinity of these deposits the ore is almost entirely free from sulphides. Of the two largest pipe deposits—namely, Abenab in the northeast and Uris in the northwest—the former is some 200 by 120 feet across at surface and so far has been developed to a depth of over 200 feet, while in the latter deposit the pipe was 50 to 60 feet wide and pinched out at a depth of about 250 feet. At Uris, however, a considerable quantity of vanadium was recovered from the pockets of eluvial[9] ore at surface, and it was only when these operations were being abandoned that the existence of the mineralized pipe was discovered. Smaller pipe deposits have been worked at Tsumeb West, Uitsab, and Olifantsfontein and several places in the Otavi Valley and in the kopjes to the east of Guchab, while eluvial ore has been recovered from Uris and the adjacent workings at Karavatu and also from Berg Aukas. From the latter deposit some 13,000 tons of sand from the flats below the zinc-vanadium outcrop yielded over 700 tons of concentrates.

According to reports, vanadium concentrates produced in and exported from South-West Africa from 1920 to 1930 have been as follows:

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[8] Work cited, pp. 270–271.

[9] Detrital.

Vanadium concentrates produced in and exported from South-West Africa, 1920–1930

Year	Production		Exports		Year	Production		Exports	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1920	360	£18, 000	278	£13, 880	1926	5, 058	£263, 000	1, 141	£58, 000
1921	650	32, 500	387	19, 055	1927	3, 038	158, 000	1, 376	68, 500
1922	1, 981	99, 000	711	35, 551	1928	3, 339	126, 800	4, 143	152, 000
1923	1, 452	75, 500	1, 167	59, 217	1929	3, 036	117, 000	5, 185	222, 000
1924	2, 122	110, 300	1, 606	83, 433	1930	4, 461	176, 200	3, 817	150, 700
1925	3, 740	194, 500	2, 234	116, 100					

USES

Vanadium is used for making tough steels, but its use would undoubtedly increase much faster if the price could be lowered. As an illustration, it has been said that in the highly competitive manufacture of automobiles, makers of one machine balked at using certain steel because the added cost was 11 cents per car.

In high-speed steels there is apparently a tendency to somewhat increase the vanadium content. One such steel contains tungsten, 17 per cent; chromium, 4 per cent; vanadium, 1.75 to 2.3 per cent; carbon, 0.8 per cent; remainder, iron.

The practice, in adding vanadium to steel, has heretofore been to add the element in the form of ferrovanadium, but during the last couple of years steel makers have bought some vanadium oxide for introduction into the steel through the slag.

In the contact process of manufacturing sulphuric acid and in the making of certain organic chemicals, the use of vanadium is apparently increasing. Informative articles on the use of vanadium catalysts will be found in the Vancoram Review, volume 1, 1930, page 42, and volume 2, 1931, pages 4 to 8.

LEGISLATION

The tariff act of 1930, which became effective June 18, contains the following provisions affecting vanadium:

Par. 91. Vanadic acid, vanadic anhydride, and salts of the foregoing, 40 per centum ad valorem; chemical compounds, mixtures, and salts, wholly or in chief value of vanadium, not specially provided for, 40 per centum ad valorem.

Par. 301. (*l*) Boron carbide, chromium carbide, vanadium carbide, chromium nickel, chromium silicon, chromium vanadium, and manganese copper, 25 per centum ad valorem.

(*m*) Ferrophosphorus, ferrotitanium, ferrovanadium, ferrouranium, ferrozirconium, zirconium ferrosilicon, ferroboron, ferroaluminum vanadium, ferromanganese vanadium, ferrosilicon vanadium, and ferrosilicon aluminum vanadium, 25 per centum ad valorem.

(*n*) Barium, boron, calcium, columbium or niobium, strontium, tantalum, thorium, titanium, uranium, vanadium, zirconium, alloys of two or more of these metals, or alloys not specially provided for of one or more of these metals with one or more of the metals aluminum, chromium, cobalt, copper, manganese, nickel, or silicon, 25 per centum ad valorem.

PRICES

There has been no known market for ores in the United States during 1930. Fused oxide carrying 85 per cent or more V_2O_5 sold for 70 cents to $1.35 per pound.

Ferrovanadium carrying 34 to 38 per cent vanadium sold for $3.15 to $3.50 per pound for the contained vanadium, the price depending upon quantity and quality.

URANIUM AND RADIUM

PRODUCTION IN THE UNITED STATES

The market is still so overshadowed by the very rich ores of the uranium deposits at Chinkolobwe, near Elisabethville, Katanga, Belgian Congo, that the only known demand for American ores has been for a small quantity of rich carnotite ore to be used in making radioactive drinking water.

H. W. Balsley continued to produce small quantities of rich ore from the Yellow Circle claims on the southwest side of La Sal Mountains about 16 miles southeast of Moab, Utah, and J. H. Overall mined and shipped some ore from claims near Egnar, San Miguel County, Colo.

J. W. Lewis mined a considerable quantity of carnotite-bearing ore on the mesa southeast of Gateway, Colo., but did not ship or sell any.

IMPORTS

Imports of uranium and radium compounds into the United States during the past four years are shown in the following table:

Uranium and radium salts imported for consumption in the United States, 1927–1930

Class	1927		1928		1929		1930	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Uranium oxide and salts of pounds..	67,692	$58,971	165,378	$145,557	272,913	$344,548	231,194	$306,566
Radium salts grams[1]..	7.259	393,140	10.97	566,977	10.69	579,085	16.86	924,852
Radioactive substitutes......	(2)	522	(2)	2,913	(2)	183	(2)	971
	....	452,633	....	715,447	....	923,816	....	1,232,389

[1] Bureau of Foreign and Domestic Commerce publishes quantities as follows: 1927, 112 grains; 1928, 169 grains; 1929, 165 grains; 1930, 260 grains.

[2] Weight not recorded.

Of the total uranium salts imported, more than 200,000 pounds were sodium uranate, valued at $1.50 per pound. A few thousand pounds of uranium nitrate, valued at $1.90 per pound, and a small quantity of black uranium oxide, valued at $2.25 per pound, were also imported.

PRODUCTION IN FOREIGN COUNTRIES

The known production of radium was confined to the Belgian Congo and Czechoslovakia. Some work is said to have been done on uranium deposits in Portugal, the ores from which were shipped to France for reduction, but no details are at hand. Nothing is known to the writer concerning operations at the deposits in the Tyuya Muyun Mountains in Russian Turkestan.

Belgian Congo.—Particulars regarding the Belgian Congo deposits owned by the Union Minière du Haut Katanga are still heavily veiled in secrecy, and no word of reserves or tenor of ore is allowed to reach the public. Governmental figures for shipments of minerals from Belgian Congo include 944 [metric] tons of uranium ore in 1929 and 1,296 [metric] tons in 1930. The ore minerals are uraninite and oxidation minerals, including curite, torbernite, and others.

Sales of radium as given in the company's annual reports have been as follows:

	Grams		Grams
1923	20	1928	42
1924	22	1929	60
1925	20	1930	60
1926	20		
1927	26	Total sales to end of 1930	270

Approximately 17 grams were imported into the United States in 1930, all from Belgium.

Czechoslovakia.—In Czechoslovakia, according to S. E. Woods, assistant trade commissioner, the Government-owned pitchblende mines and laboratories at Jachymov (formerly called St. Joachimsthal) produced 28.3 metric tons of selected ore in 1930 (33.5 tons in 1929), 3.578 grams of radium (3.521 grams in 1929), and 20,267 kilograms of uranium colors (23,347 kilograms in 1929). These figures seem to indicate that the ore was picked to about 42 per cent U_3O_8.

Canada.—The occurrence of uraninite (crystallized uranium dioxide with more or less impurities) in a pegmatite near Wilberforce, Ontario, has attracted considerable attention for several years. Spence and Carnochan[10] studied the deposit and say that the "development work done during 1929 suggests possibilities," but from the published descriptions of the deposit there seems to be little promise of large production. A carload of the material was sent to the mines branch ore-dressing laboratory at Ottawa, which made a recovery of 2.56 pounds of U_3O_8 per ton.

Early in 1930 pitchblende was discovered on claims of the Eldorado Gold Mines (Ltd.), at the east end of Great Bear Lake, Northwest Territories. Hand samples only had been obtained from small lenticular masses in quartz veins that were traced several hundred feet. The data at hand are too meager to allow reasonable prophecies on the value of the deposit.

USES

The uses of radium are few, but the value of radium for these uses is largely to be determined, not in the ordinary terms of dollars and cents but in terms of human misery saved and of human knowledge acquired. From such a viewpoint radium has been invaluable.

The principal use of radium is therapeutic. For the removal of birthmarks, the cure of fibroid tumors, and the alleviation or cure of certain cancers radium has become a standard remedy. It has also been used successfully in certain cases of lukemia, tubercular glands of the neck, and other diseases.

In the hearings before the subcommittee of the committee on mines and mining, Dr. Howard A. Kelly[11] said that if radium had no more value than as a palliative "it would be well worth all our efforts."

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[10] Spence, H. S., and Carnochan, R. K., The Wilberforce Radium Occurrence: Preprint Canadian Inst. Min. and Met. Bull., 1930, 37 pp.

[11] Manufacture of One Gram of Radium, Hearing before a Subcommittee of the Committee on Mines and Mining, House of Representatives, 71st Cong., 2d sess., on H. R. 4811, Feb. 11 and 25 and Mar. 4, 11, and 25, 1930, p. 54.

The service that the discovery of radium has rendered science and through science the electrical industry (including the radio industry), by the new conceptions of the constitution of matter that it has given, can not be valued in dollars but is very great.

One of the newer uses for radium is in the examination of steel for flaws. The radium in a tube is placed on one side of the metal, and a photographic plate in a holder is held on the other side. On developing the plate, flaws in the metal will be shown by differences in the exposure of the plate.

The use of radium for ionizing air, thus making it a conductor that prevents the accumulation of static charges of electricity in rolling or molding rubber, has been reported.

QUANTITY OF RADIUM IN UNITED STATES

From the time that American radium factories first produced radium salts in 1913 to the last recorded output, that in 1926, about 202.5 grams of radium were isolated. In addition to this quantity ores were shipped to Europe which contained an inexactly known content of radium.

It is thought that at least 3 grams were imported before 1923, at which time Belgian radium began to arrive in this country. Production and imports are shown in the following table.

Radium produced in and imported into the United States, 1913–1930, in grams

Year	Production	Imports	Year	Production	Imports
1913	2.1	[2] 3.00	1923	12.212	8.75
1914	9.6		1924	8.042	8.1
1915	4.71		1925		9.27
1916	8.17		1926		10.97
1917	[1] 13.83		1927		7.26
1918	[1] 22.79		1928		10.97
1919	28.648		1929		10.69
1920	32.539		1930		16.86
1921	35.693				
1922	21.189			202.523	85.87

[1] Revised figures.

[2] Estimated.

The total production in and imports into this country to the end of 1930 have been about 288.4 grams. Since 1916, including the Great War, probably not more than an average of 2 grams per year has been used in luminous materials, a total of not more than 30 grams. What exports have amounted to is unknown, but probably they have not exceeded 20 grams, so that, making no allowance for broken tubes and other losses, there would appear to be still in this country 238 grams of radium. This is very much more than can be accounted for from known holdings, and there may have been much larger exports than have been recorded. It is expected that a canvass will be made to determine the quantity now held in the United States.

LEGISLATION

Paragraph 302 (*m*) of the tariff act of 1930 provides a duty of 25 per centum ad valorem on ferrouranium, and paragraph 302 (*n*) provides a duty of 25 per centum ad valorem on uranium in alloys. "Uranium, oxide and salts of" are on the free list.

A bill (H. R. 4811) was introduced in the House of Representatives by Hon. Clyde Kelly, October 28, 1929, proposing that the Bureau of Mines be authorized and directed to manufacture a gram of radium for the use of the United States Veterans' Bureau, for which purpose $100,000 was to be appropriated. Hearings were held by a subcommittee of the committee on mines and mining in February and March before which representatives of the United States Bureau of Mines, Dr. Truman Abbe, Dr. Howard A. Kelly, and Dr. W. Neill, appeared by invitation. The United States Geological Survey was requested by the subcommittee to investigate the radium deposits of Colorado and Utah and determine whether there was sufficient ore to produce a gram of radium. Dr. G. F. Loughlin of the Geological Survey made a reconnaissance of the deposits, and the Geological Survey reported on November 25, 1930, that there were adequate supplies of ore in at least three different districts.

In response to a request of the subcommittee that the Bureau of Mines investigate the processes for producing radium, the bureau published a report by H. A. Doerner, entitled "Processes for Extracting Radium from Carnotite" (Report of Investigations 3057, December, 1930, 35 pp.), in which the known processes were reviewed and compared. Doerner concludes:

> The only possibility of obtaining radium from carnotite at a low cost lies in the concentration of low-grade ores and the possible development of new methods or the modification of standard methods of treating concentrates more efficiently. The advantages of a preliminary roast as an aid to both concentration and chemical treatment of concentrates have not been generally appreciated.
>
> Current production of vanadium from carnotite [bearing ores] indicates that the vanadium recovered from carnotite [bearing ores] of relatively low radium content will pay for the cost of mining, concentration, and the recovery of the vanadium. This may appear strange when radium ores of similar vanadium content do not yield a profit when treated for the recovery of both radium and vanadium. It is because vanadium ores of low radium content, being more abundant, can be mined more cheaply and the process of extracting the vanadium alone is inexpensive and can be accomplished economically near the mine, thus saving shipping costs. The radium-bearing slime obtainable from the vanadium operations is equivalent, except as to vanadium content, to concentrates from a low-grade ore. A study of production costs indicates that radium can be recovered by suitable methods from such a slime, at a cost which is less than the present wholesale price. As in the metallurgy of many other metals, efficient large-scale operations on low-grade ores may be more profitable than the search for ores of high grade.
>
> Of all the standard proved methods for the extraction and recovery of radium from carnotite, a modification of the nitric acid method, commercially demonstrated by the United States Bureau of Mines, appears to be best adapted to the treatment of slime concentrates.

Final action had not been taken on the bill at the end of the year.

METALLURGY

Driggs and Lilliendahl of the Westinghouse Lamp Co. research laboratory at Bloomfield, N. J., delivered a paper before the American Chemical Society at its Atlanta meeting[12] in which they described the preparation of pure uranium powder by the electrolysis of potassium uranous fluoride in fused calcium and sodium chlorides. The powder was washed in water and dried in vacuo, pressed into a pellet, placed in a crucible lined with thoria, and fused to a coherent mass in an evacuated high-frequency induction furnace. A chemical analysis of the metal gave as the only impurities: C, 0.06 per cent; Fe, 0.05; and Si, 0.01. It can also be made into workable form by pressing, sintering, and swaging, as is done with tungsten and molybdenum. The metal can be cold rolled, hammered, or drawn. It has a melting point of 1,690° C. and a specific gravity of 18.9 to 19.07 in small wire. Uranium has the hardness of soft steel, but under cold working the Brinell hardness rises from 92 to 112. Fine particles of newly made metal or newly pressed masses ignite spontaneously in the air, and a polished surface quickly becomes covered with oxide. Uranium is photosensitive to ultra-violet light and may be used in the construction of cells for its measurement. Because of the great number of electrons in its atoms it is said to be better than tungsten for Roentgen-ray (X ray) targets. As uranium is radioactive, it ionizes a surrounding gas, making it a conductor. This property is utilized in making electrodes for gas-discharge devices, where a low initial breakdown voltage is desired.

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[12] Driggs, F. H., and Lilliendahl, W. C., Preparation of Metal Powders by Electrolysis of Fused Salts; (1) Ductile uranium: Ind. and Eng. Chem., vol. 22, 1930, pp. 516–519.

The total production of uranium to May, 1930, had been only about 3 pounds. The prices for wire and sheet were based on $900 a pound for the sintered metal. Increased production would soon lower the price.

PRICES

Radium is quoted by the agency of the Union Minière du Haut Katanga in New York at $70 per milligram for lots of less than 1 gram; $65 per milligram for lots of 1 to 2 grams; $60 per milligram for lots of 2 to 3 grams; $55 per milligram for lots of 3 to 4 grams; and $50 per milligram for lots of 4 grams or more.

No quotations for uranium salts are known to have been published, but the sales prices of imported salts are given on page 140.

BIBLIOGRAPHY

The following articles and patents on vanadium, radium, and uranium are among those that appeared or became available in 1930.

ADADUROV, I. E., and BORESKOV, G. K. Dependence of the catalytic activity of vanadium pentoxide on its mode of combination with silica. Ukraine Chem. Jour., 1929, vol. 4 (Tech.), pp. 259–266. Claim that vanadium pentoxide deposited on dehydrated silicic acid has a greater catalytic action on the oxidation of sulphur dioxide than in the absence of silica.

——— Deposition of vanadium pentoxide as catalyst on chamotte. Jour. Chem. Ind. (Russia), vol. 6, 1929, pp. 208–209. A solution of ammonium metavanadate, slightly acidified with hydrochloric acid, is boiled with chamotte (crushed fire brick). Precipitation is incomplete even after 1.5 hours.

——— Vanadium catalyst. Zhur. Prikladnoi Khim., vol. 3, 1930, pp. 11–20. A vanadium sulphuric acid catalyst is prepared from a mixture of sodium or potassium silicate, sodium or potassium vanadate, and sodium or potassium stannate solutions which are neutralized by adding small portions of sulphuric acid; the whole is heated to 50° to 70°. The precipitate is filtered, pressed, dried, and finally brought gradually up to the contact temperature. The catalyst so prepared has considerable mechanical strength. It gives 99 per cent conversion of a gas containing 7 per cent of

SO_2 at a velocity of 100 c. c. per minute at a temperature of 400°, and a length of the contact layer of 20 cm. The chemical composition of this catalyst after contact was SiO_2, 23.3; SnO_2, 9.9; V_2O_5, 5.2; SO_3, 29.4. This catalyst is immune against H_2O, As_2O_3, HCl, HF, etc. The SO_2 does not need to be treated and dried before contact. This catalyst can stand temperatures up to 1,000° without noticeable deterioration.

Askenasy, P., and Elöd, E. Treatment of vanadiferous ores. German Patent 461959, April 21, 1925. The finely ground ore is digested with nitric acid and oxygen under pressure, sulphuric acid also being added when the ore is free from sulphur.

Becket, F. M. (to Electro Metallurgical Co.). Smelting of chromium, manganese, and vanadium ores. British Patent 309594, April 10, 1929. Ferroalloys of the above metals are obtained by the silicothermic reduction of their oxides or alkaline-earth salts in a self-propagating reaction mixture of such a composition that the slag formed contains a relatively high percentage of the desired metal which is subsequently recovered by reduction with carbon in an electric furnace. For example, a mixture of vanadium pentoxide, ferrovanadium-silicon, lime, steel scrap, and sodium nitrate is ignited to obtain ferrovanadium containing 35 per cent V, 7 per cent Si, and less than 0.3 per cent C, and a slag containing about 10 per cent V. The slag is then smelted with carbon to produce the ferrovanadium-silicon alloy for the first operation.

Broz, K. Vanadium in mineral oil ash. Arhiv za Hemiju i Farmaciju, vol. 4, 1930, pp. 86–91. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, 1930, p. 675. In the analysis of mineral oil ash·from Maracaibo, Venezuela, the vanadium was determined gravimetrically with $HgNO_3$ and volumetrically with $KMnO_4$. The analysis gave a vanadium content of 45.38 per cent.

Canadian Mining Journal. Consolidated sends air pilot to Africa. Vol. 51, 1930, p. 751. Consolidated Mining & Smelting Co. of Canada has been granted an exclusive concession to prospect for base and precious metals over a large area in what prior to the war was German West Africa. No details of the company's plans for the exploration of the area have been given out, but the recent dispatch of W. G. Jewett, one of the company's expert airplane pilot engineers, to Africa indicates that a preliminary reconnaissance survey will be made from the air. The district is reported to contain some promising showings of copper-gold ore. Ores of vanadium also are reported to have been found in the district.

Carlborg, Harald. Världens Vanadinmalmstillgangar. (The world's vanadium resources.) Jernkontorets Annaler, vol. 114, 1930, pp. 51–76. General summary. Discusses the forms of vanadium minerals, the uses of vanadium, the price of vanadium since 1922, the geographical distribution, production statistics, and future developments. It is concluded that the present world production of about 1,000 metric tons per annum can be maintained for several decenniums without resorting to low-grade ores.

Challansonnet, Jean, Nickel vanadium and nickel molybdenum cast irons. 1. Nickel vanadium cast irons. Rev. Metal., vol. 27, pp. 573–603; Bull. assoc. tech. fonderie, vol. 4, 1930, pp. 291–315; Chem. Abs., vol. 25, 1931, pp. 1197–1198. The addition of nickel and vanadium improved the tensile strength and the resistance to shearing in the cast irons owing (1) to the refining action of nickel on the precipitated graphite and (2) to the increase in combined carbon content caused by the vanadium.

Chamie, Caillet, and Fournier. Tables relatives à la décroissance et à l'accumulation du radon ou émanation du radium. Paris: Gauthier-Villars et Cie. 1930 (?), 14 pp.

Chance Bros. and Gould. Vanadium and chromium in glass. British Patent 316464, September 8, 1928. Small quantities of a compound of chromium and vanadium oxide makes ordinary clear window glass more suitable for the protection of pictures and fabrics from the deterioration caused by ordinary daylight. It causes the adsorption of rays of wave length shorter than 38.

Cook, S. J. Canadian output of metals expands. Eng. and Min. World, vol. 2, 1931, pp. 97–98. An interesting discovery of vanadium in the Sudbury district was reported late in the fall. Diamond drilling in the township of Drury yielded cores said to assay vanadium, 6.3 per cent; nickel, 1.3 per cent; gold, $6.20 per ton; and platinum, $1.20 per ton. Further work is being done to determine whether the find is of commercial value.

Crowne, A. A. J. Electric discharge devices. British Patent 332734, July 4, 1929. A cathode is used comprising a radioactive substance such as uranium and a photo-electric substance such as rubidium or potassium. Various details of manufacture and operation are described.

Diffenbach, A. Mineralogische und chemische Untersuchung von Descloizit und Mottramit aus dem Otavibergland (Südwestafrika). Ztschr. Kristal., vol. 74, 1930, pp. 155–188. These minerals occur in sandy pockets in limestone and dolomite. The large series of specimens examined from various localities show five types grading from distinct crystals to reniform masses. Crystals of descloizite are dark green to black, but reddish on fractured surfaces; the streak is yellowish green. Some crystals are honey yellow. On crystal faces the hardness is 4½ to 5, but in the interior 3½ parallel to the C-axis and 3 perpendicular thereto. Measurable crystals from Uitsab and Olifantsfontein are pyramidal in habit with curved faces. Seven analyses are given of descloizite (I and II of crystals from the same specimen, showing a slight difference in composition; III of dark and IV of light crystals; all from Uitsab) and three of mottramite (V to VII from Tsumeb and Uitsab).

	V_2O_5	As_2O_5	P_2O_5	PbO	CuO	ZnO	FeO	H_2O (hydrographic)	H_2O	Total	Specific gravity
I	22.45	------	------	55.16	2.75	17.30	------	0.08	2.18	99.92	5.988
II	22.61	------	------	53.94	2.94	18.50	------	.07	2.23	100.29	
III	22.58	------	------	54.68	2.95	16.77	0.62	.07	2.22	99.88	5.992
IV	22.66	------	------	54.79	2.95	16.70	.63	.01	2.22	99.96	5.990
V [1]	22.15	1.15	Trace.	50.33	22.08	.46	.52	.06	4.73	99.78	6.033
VI [1]	21.68	1.43	0.09	49.49	20.76	.68	------	.07	4.31	99.87	6.121
VII [1]	21.40	1.27	.10	49.93	19.89	.43	------	.07	4.24	99.74	6.107

[1] V, including MnO trace. VI, Al_2O_3, 0.47; Fe_2O_3, 0.32; MnO, 0.39; CaO, trace; and SiO_2, 0.18 VII, Al_2O_3, 0.62; FeO_3, 1.12; MnO, 0.21; CaO, 0.10; and SiO_2, 0.26.

The analyses of descloizite (I to IV) agree closely with the formula $4(Pb,Zn,Cu)O.V_2O_5.H_2O$, and those of mottramite (V to VII) with $4(Pb,Cu)O.V_2O_5.2H_2O$. Mottramite with the extra molecule of water is regarded as merely a variety of descloizite; cuprodescloizite with 6 to 12 per cent CuO is an intermediate variety [but no proof is given that the material examined is the same as the original mottramite of Roscoe]. Sections of crystals show a zonal structure with bands of different colors and pleochroism; a complex zonal structure is also shown in reflected light on polished and etched surfaces.

Dines, H. G. Uranium in Cornwall. Min. Mag. (London), vol. 42, 1930, pp. 213–217. (One sketch map.) Gives a list and short description of the mines in Cornwall which are known to have produced uranium minerals. The South Terras mines seem to have been of the most importance.

Fioletov, A. Occurrence of rare elements in clays. Keram. Rundsch., vol. 35, 1927, pp. 270–272; Chem. Zentralb., 1929, p. 2489. Primary Russian clays contain 0.22 to 1.35 per cent TiO_2 and secondary clays, 0.94 to 2.72 per cent. The clays and kaolins examined contained 0.004 to 0.075 per cent V_2O_5. A method for the determination of vanadium in clays is described.

French Patent 669226. Vanadium in nonfalsifying paper. The paper is prepared by impregnating it with bichromate, salts of vanadium copper and chlorates. The ink used is composed of a salt of phenylamine, $PhNH_2$, salts of PhNHMe or $PhNMe_2$, water, glycerol, and gum arabic and is colored with nigrosine or lamp black.

Gilbemeister, Alphonse, and Compagne, Emile. Vanadium ores. French Patent 692654, June 24, 1929. Ores of vanadium, particularly vanadates of lead or other metals, are submitted in the presence of a suitable flux to a regulated reducing action to obtain the heavy metals in the metallic state and the vanadium in the form of the insoluble trioxide.

Green, J. B. (to Franklin M. Warden). Rod for use in arc welding or cutting. United States Patent 1783013, November 25, 1930. "A combination of a ferrous arc electrode and a weld assisting coating, said coating containing a uranium oxide compound and a tungsten oxide compound, about two parts of the uranium oxide compound being used to about every one part of the tungsten oxide compound."

Halliwell, G. P. (to Westinghouse Electric & Manufacturing Co.) Thermionic cathodes. British Patent 334460, December 5, 1929. A thermionic cathode comprising a homogeneous body containing a base consisting wholly or in part of one or more metals of the nickel group and a deoxidizing agent (titanium, tungsten, molybdenum, thorium, vanadium, tantalum, silicon, manganese, aluminum, chromium, or metals of the rare earth group such as cerium or zirconium or mixtures thereof) and one or more alkaline earth metal oxides disseminated throughout the body.

Harney, T. R. (Monsanto Chemical Works). Vanadium catalysts for sulphuric acid. Chem. and Met. Eng., vol. 37, 1930, p. 374. Vanadium catalysts owing to their freedom from poisoning give better results than platinum in the manufacture of H_2SO_4. Vanadium requires an expert for its preparation but is less delicate in operation.

Heany, J. A. (to Arcturus Radio Tube Co.). Uranium metal and product and process of making the same. United States Patent 1759454, May 20, 1930. An alloy of uranium and molybdenum, the uranium not exceeding 5 per cent of the constituents of the alloy, for use as a filament in thermionic tubes.

Hevesy, G. v., Alexander, E., and Würstlin, K. The abundance of elements of the vanadium group in eruptive rocks. Ztschr. anorg. allgem. Chem., vol. 194, 1930, pp. 316–322. Chem. Abs., vol. 25, 1931, p. 1471. Two hundred and eighty-two samples of eruptive rocks were examined for vanadium, columbium, tantalum, and protoactinium content. The mean columbium and tantalum content was 3.2 by 10^{-7} or 2.4 by 10^{-7} g. per gram of rock. The relation of atomic abundance of columbium and tantalum is 2.6. The vanadium content was 2 by 10^{-4} and the protoactinium content (calculated from the radium content of 1.2 by 10^{-12}) 7 by 10^{-13} per gram. A comparison was made of the abundance of these elements of the vanadium group in the eruptive rocks and in meteorites.

Holmes, H. N., and Elder, A. L. Vanadium compounds as catalysts for the oxidation of sulphur dioxide. Ind. and Eng. Chem., vol. 22, 1930, pp. 471–473. A compound of calcium, potassium, sodium, and vanadium salts gave 98 per cent conversion of SO_2 to H_2SO_4 in an 8 per cent mixture of SO_2 in air. A compound containing tungsten gave only 50 per cent conversion.

Iimori, Satoyasu. The vanadium content of acid earths and minerals. Bull. Inst. Phys. Chem. Res. (Tokyo), vol. 9, 1930, pp. 852–4. Abstracts 82–3 published in English with Sci. Papers Inst. Phys. Chem. Res. (Tokyo), vol. 14, 1930, pp. 271–3. Vanadium has been determined in a number of Japanese acid earths and minerals such as mica, clay, pumice, sandstone, and rhyolite. The vanadium content of the acid earths is between 0.0041 and 0.018 per cent V_2O_3. Evidence is given to show that the oxidaselike action of the acid earths in the indophenol reaction is not due to structural characteristics but to the presence of small amounts of manganese or cerium; vanadium and iron do not give this reaction. Analyses of rhyolite and of red clay in which large crystals of native arsenic are found gave 0.012 and 0.18 per cent of V_2O_3, respectively. (Complete analyses are given.) Thinks that the catalytic action of the vanadium on iron arsenide and iron sulpharsenide minerals, particularly arsenopyrite found in the Hosonoguchi mine near Akadani, has formed the native arsenic.

Khlopin, V. G., and Pasvik, M. A. Migration of uranium and radium in the principal veins of the Tyuja-Mujun deposits. Trav. radium et minerais radioactifs. Acad. Sci. U. S. S. R., vol. 3, 1928, pp. 105–110. In spite of the occurrence of the phenomena of the migration of uranium and radium in these veins, for the ore mass as a whole the relation between radium and uranium corresponds exactly with the condition of radioactive equilibrium. Two forms of secondary accumulation of the radium are observed; in one the radium is crystallized with barium as copper-yellow radioactive barite and in the other, conditioned probably by adsorption, it occurs in masses or ore of colloidal character.

Knight, C. W. Pitchblende at Great Bear Lake, Northwest Territories, Canada. Canadian Min. Jour., vol. 51, 1930, pp. 962, 965–976. The pitchblende is found in two quartz veins cutting a pink coarse-grained granite of pre-Cambrian age. The pitchblende is in lenses 1 foot or more long and a foot wide. The veins also carry nickel, cobalt, native bismuth, chalcopyrite, and other minerals. A partial analysis gave: U_3O_8, 52.68; PbO, 8.42; and acid insoluble, 39.96 per cent. Specific gravity, 5.90.

Labasine, G. Sur les gisements de substances minérales radioactives dans l'arrondissement de Khakassk. Geol. and Prospect. Service Trans. of U. S. S. R. (Moscow), November 19, 1930, 56 pp. (French summary, 55, 55–56.) None of the rocks examined seem to give promise of a commercial producton of radioactive minerals.

Marden, J. W. (to Westinghouse Lamp Co.). Method for producing uranium and uranium-zinc alloys. United States Patents 1728940 and 1728942, September 24, 1929. "The method of producing uranium metal which comprises reducing simultaneously in a sealed container a uranium compound admixed with a proportion of a zinc compound with calcium in the presence of calcium chloride, recovering the metal powder product in any suitable manner, and thereafter heating the metal powder in a high vacuo to vaporize the zinc component thereof and to sinter the uranium."

McLennan, J. C., and McKay, R. W. Crystal structure of uranium. Trans. Roy. Soc. Canada, vol. 24, sec. 3, 1930, pp. 1–2. An X-ray analysis of the crystal structure of metallic uranium was made by the powder method. The calculated spacings are for a body-centered cubic arrangement with the side of the unit cell equal to 343 by 10^{-8} cm. The lines corresponding to the 222 and 004 planes were not observed. Calculated from the data obtained the density is 19.6.

Mining Journal (London). Vanadium discoveries in the Urals. Vol. 168, 1930, p. 25. Last summer an expedition was sent to the Visherski iron-ore region in the North Urals by the Ural section of the Institute of Applied Mineralogy jointly with the Ural Metal Trust. The institute has now received valuable data on the mineral resources of the region. In addition to large discoveries of iron ore, there is reason to believe that some of the deposits examined contain considerable quantities of vanadium. It is confirmed that the titanium-magnetite deposits in the Yubreshka district contain about 1 per cent of vanadium.

Monsanto Chemical Works. Catalysts. British Patent 298142, May 25, 1927. Catalysts are prepared by forming by a wet process a complex silicate containing vanadium in nonexchangeable form (of which at least part is less than pentavalent) with or without other chemical groups such as boric, phosphoric, tungstic, molybdic, and other weak acids, and stearic and plumbic acids and zinc, aluminum, chromium, and other amphoteric hydrates and subjecting the solid complex silicate to the action of an acid and an oxidizing agent to convert the vanadium into V_2O_5 and pyrovanadates embedded in the rigid framework of the silicate. Catalysts thus prepared are suitable for the oxidation of inorganic substances such as sulphur dioxide and of organic substances such as toluene to produce benzaldehyde and benzoic acid, cresol to produce salicyaldehyde and salicylic acid, and MeOH or EtOH to produce CH_2O or acetaldehyde. Numerous details and examples are given.

Nature. Report of the Government laboratory (Great Britain). Vol. 126, 1930, p. 697. States that 200 mg. of high-grade radium salt were "recovered from decayed luminous paint."

Petinot, N. Vanadium additions improve steel. Steel, vol. 87, No. 8, 1930, pp. 43–45, 48; No. 9, pp. 47–49; No. 10, pp. 56–60. The effects of adding vanadium to steel, the properties of the products, and their uses are discussed.

Piña de Rubies, S. The presence of vanadium in Spanish rocks and minerals. Anales soc. españ. fis. quim., vol. 28, 1930, pp. 1110–1116. Vanadium was found in peridotites, basalts, limburgites, pyroxenites, granites, labradorites, quartzites, schists, sea sand, clay, and recent meteorites, and in many bismuth, manganese, and tin ores. If titanium is present, vanadium is also, and vice versa.

Robson, S., and Lewis, P. S. Vanadium catalysts for use in the oxidation of oxidisable gases (sulphur dioxide). British Patent 334862, June 8, 1929. A mixture of dried silica gel with 5 to 10 per cent of vanadium pentoxide, ammonium vanadate, or an alkali vanadate and a small quantity of a promoter such as stannous chloride is bonded with sodium hydroxide or silicate and with a vegetable gum to form a thick paste which after partial drying is made into pellets. These are then treated cold with a stream of sulphur dioxide until they show an acid reaction, heated to 400° in a stream of hot air, and transferred to the catalyst chamber for the manufacture of sulphuric acid by the contact process.

Rutherford, Ernest, Chadwick, James, and Ellis, C. D. Radiations from radioactive substances. Cambridge Univ. Press. (London), 588 pp.

Saklatwalla, B. D. (to Vanadium Corporation of America). Vanadium recovery from ores or compounds. United States Patent 1779856, October 28, 1930. The process of recovering vanadium from ores or other material containing it, which comprises subjecting an aqueous pulp of such material to the action of chlorine gas.

——— Manufacture of vanadium-aluminum-silicon alloys. British Patent 305202, December 20, 1928. United States Patent 1727180, September 3, 1929. The alloy contains 40 to 90 per cent vanadium, 3 to 15 per cent aluminum, and 5 to 30 per cent silicon; the remainder is chiefly iron.

Société de Produits Chimiques des Terres Rares (France). Procédé de traitement des minerais complexes de vanadium. French Patent 669115, March 13, 1929. After putting the vanadium salts into a sulphuric acid solution and after their maximum oxidation, the solution is hydrolyzed by raising the temperature; the process is stopped as soon as the vanadic acid becomes 95 per cent pure. The mother liquor is purified by a complete neutralization; the precipitate obtained is washed and then dissolved in sulphuric acid; the solution is reduced, thus permitting the precipitation of metals by hydrogen sulphide; the metals are separated by filtration. After this the liquor is concentrated until crystallization of ferrous sulphate is obtained; the separated solution is then again ready for obtaining vanadic acid. The treatment can be repeated; after the treatment has been applied three times it can be considered that the separation of the vanadium is complete. By successive operations it is possible to separate lead in the form of lead sulphate and copper in the form of metal or of sulphide. The zinc remains in solution.

——— Vanadium ores. French Patent 36972, March 13, 1929. Additional to French Patent 669115. In treating vanadium ores by the process of French Patent 669115, iron in the form of $FeSO_4$ is added to the solutions from which it is desired to recover vanadic acid if the ores are free from, or insufficient in, iron to obtain this separation. This addition may be made before or after the first hydrolysis of vanadic acid.

Société des Encres Plateau. Procédé permettant des écrits et copies indelébiles. French Patent 669226, February 6, 1929. Patents the use of an indelible ink which contains a vanadate of ammonium and copper salts.

Stevens, R. H., Norris, G. C., and Watson, W. N. (to Rhodesia Broken Hill Development Co. (Ltd.)). Recovery of vanadium. United States Patent 1733700, October 29, 1929. Covers the process quoted on page 135 of this report.

Stratenwerth, Gerhard. Bronze. German Patent 505963, April 21, 1928. Bronze suitable for machine bearings consists of 97 per cent copper, 2 per cent tungsten, and 1 per cent vanadium.

Succop, J. A. (to Heppenstall Co.). Alloy steel. United States Patent 1775615, September 9, 1930. A steel intended particularly for razor blades is of about the following composition:

	Per cent		Per cent
Carbon	0.70– 0.75	Nickel	0.80– 1.00
Chromium	10.00–12.00	Silicon	.20– .45
Manganese	.15– .30	Vanadium	.35– .45
Molybdenum	.40– .50	Iron	Balance.

Tananaev, ———, and Panchenko, ———. Detection of vanadium and tungsten. Jour. Russian Phys. Chem. Soc., vol. 61, 1929, p. 1051. Put a drop of a solution of equal volumes of analine and strong hydrochloric acid on a strip of filter paper and place over it a drop of solution to be tested, which has previously been oxidized with strong nitric acid to assure the pentavalent condition of the vanadium. Vanadic acid oxidizes the aniline, forming an intense blue color. Anions of strong oxidizing power, such as chromates, chlorates, hypochlorites, and manganates, must be reduced by boiling with hydrochloric acid. Delicacy is 0.003 mg. to one drop of solution. To detect tungsten in a tungstate, a drop of hydrochloric acid is placed upon it. A yellow spot of tungstic acid is formed which becomes blue with stannous chloride. The blue color is intensified upon the addition of ammonium sulphocyanide and still further developed by hydrochloric acid. Delicacy is 0.004 mg. to one drop of solution.

Thuaud, F., Croizard, P. M., and Saint-Donat, C. S. Special steel. French Patent 692124, June 7, 1929. A steel for tools contains besides iron and carbon suitable proportions of manganese, cobalt, chromium, molybdenum, vanadium, titanium, uranium, and silicon. The steel may be used for cutting tools without the necessity for a heat treatment. An example given is C, 0.6 to 1.2; Mn, 2 to 14; Cr, 15 to 25; Mo, 8 to 15; Co, 1 to 8; V, 0.6 to 2; Ti, 0.25 to 0.7; U, 0.3 to 0.6; Si, 0.25 to 0.5; P, 0.03 to 0.05; S, 0.025 to 0.04 per cent; and Fe, the rest.

Thurschold, K. M. Alloys. Acid-resisting iron alloys. British Patent 331414, August 2, 1929. Acid-resisting iron alloys contain 15.30 per cent nickel, up to 3 per cent chromium, 0.05 to 1.5 per cent carbon, 2.5 to 10 per cent silicon, and 0.2 to 25 per cent copper; the silicon may be wholly or partly replaced by molybdenum and the nickel by cobalt. When molybdenum is present the content of molybdenum-silicon is preferably in excess of 10 per cent. Vanadium, titanium, tungsten, or manganese may be present in small quantity.

Tilley, G. S. Process of recovery of vanadium from complex solutions. United States Patent 1747403, February 18, 1930. A process of recovering vanadium from acid liquors containing iron and vanadium in their highest state of oxidation, which comprises adding an acid neutralizing reagent in amount sufficient to bring the hydrogen-ion concentration to about one ten-thousandth normal, separating the precipitate, and smelting the same with a reducing agent.

Vancoram Review. A digest of current literature on vanadium. Contains also original articles on vanadium and is issued quarterly by the Vanadium Corporation of America, Bridgeville, Pa.

Weil, J. A. (to Imperial Chemical Industries (Ltd.)). Production of catalytic material containing vanadium. British Patent 334268, June 1, 1929. The material, particularly adapted for the large-scale catalytic oxidation of sulphur dioxide, comprises a physical mixture of a vanadium compound with a siliceous diluent (for example, kieselguhr, sand) and a siliceous hydrogel. The mixture may be formed into pellets or masses, which are then dried and treated with burner gas at 450° to 500°. The vanadium compound, which is preferably a soluble vanadate, vanadite, or vanadyl compound (for example, potassium metavanadate, ammonium vanadyl oxalate) may also be mixed with a siliceous material of which a part at least is in the form of a wet hydrogel.

Weil, Kurt, and Peters, Kurt. Concentrating radioactive substances. German Patent 518205, December 21, 1929. The concentration of active substance in radioactive carbonate mixtures is raised by fractional thermal decomposition followed by washing with water. Thus, a mixture of $RaCO_3$ and $BaCO_3$ may be heated to 400° in vacuo, cooled, and washed with hot water, a residue richer in radium than the initial mixture being obtained.

Westinghouse Lamp Co. Indirectly heated thermionic cathodes. British Patent 333011, June 24, 1929. In the construction of a heating element surrounded by an insulator such as quartz, porcelain, or "insolantite," erosion and consequent failure of the heating filament, due to deleterious gases such as water vapor and carbon oxides evolved by the insulator, are prevented by providing a protecting material such as chromium, zirconium, thorium, uranium, tantalum, boron, silicon, vanadium, or titanium between the filament and the insulator to absorb and retain the gases. Chromium is preferably used, and various details of manufacture are described.

Wever, Franz, and Jellinghaus, Werner. The two-component system: iron-vanadium. Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Dusseldorf, vol. 12, 1930, pp. 317–322. A physical study of iron-vanadium alloys.

Yoshimura, Jun. Vanadium in carbonaceous minerals. Bull. Inst. Phys. Chem. Res. (Tokyo), vol. 9, pp. 878-881 (Abs. 84, in English) published with Sci. Papers Inst. Phys. Chem. Res. (Tokyo), vol 14, pp. 271–273. 1930. A peculiar-looking semianthracite coal, found in the prefecture of Fukui in a Jurassic deposit associated with sandstone, shale, liparite, and clay, has been studied. It contains little water and gives a large quantity of ash. Determinations of the ash by Hillebrand's method gave a content of 0.01 to 0.03 per cent V_2O_5—about the same as in the neighboring rocks. From these results it is concluded that the coal did not come from a vegetable source as usual but was partly carbonized through geological agencies. The ash of a coal from Heijo showed 0.091 per cent V_2O_3.

BAUXITE AND ALUMINUM[1]

By C. E. JULIHN[2]

CONTENTS

	Page
Introduction	151
World production of bauxite and aluminum	152
Rank of countries in production of aluminum and bauxite	152
Nature of bauxite	153
Making aluminum from bauxite	154
Bauxite	154
Domestic production—imports and exports	154
Total bauxite production of the United States	156
Economic setting of domestic production	156
Price	157
Market	157
Bauxite producers in the United States in 1930	158
Consumers of bauxite in the United States in 1930	158
Beneficiation of bauxite	159
Geomagnetic survey of central Arkansas bauxite region	159
Aluminum	160
Domestic production—imports and exports	160
Price	162
Uses and consumption of aluminum	162
Aluminum salts	164
Aluminous abrasives and refractories	165
Foreign bauxite and aluminum industries	165
North America	165
Canada	165
Greenland	166
South America	166
British Guiana	166
Dutch Guiana	167
Europe	167
Austria	167
Denmark	168
France	168
Germany	169
Greece	169
Hungary	170
Italy	170
Norway	171
Rumania	172
Russia	172
Spain	173
Switzerland	173
United Kingdom	174
Yugoslavia	175
Asia	176
India	176
Japan	176
Africa	177
French Morocco	177
Gold Coast	177
Oceania	178
Australia	178

INTRODUCTION

The aluminum and bauxite industries were only moderately affected by the industrial depression until the middle of 1930, when curtailment of operations became pronounced in some countries. World production of bauxite in 1930 decreased possibly as much as 15 to 20 per cent. Production in Hungary was reported as heavily reduced; however, the combined production of France and the United States, the other chief producers, decreased only about 9 per cent. World production of aluminum in 1930 decreased only about 3 per cent.

In the United States bauxite production in 1930 decreased 10 per cent, but the total supply of bauxite increased nearly 4 per cent as imports increased and exports decreased. The domestic production of aluminum in 1930 increased 2 per cent in quantity, although lowered prices caused a decrease of about 2 per cent in value. The price reduction, effective in June, amounted to 1 cent per pound. The price fixed for aluminum by the European cartel was £105 per ton previous to May, 1928, when it was reduced to £95. In October, 1930, the cartel reduced its price nearly 11 per cent to £85 per ton.[3]

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[1] Work on manuscript completed July, 1931.

[2] Statistics on domestic production prepared by H. W. Davis and figures on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

[3] Hukill, Geo. R., Swiss Aluminum Industry: Consular Rept., Apr. 27, 1931.

The consumption of aluminum in automobiles and aircraft decreased, but its use for truck and bus bodies increased. The use of strong aluminum alloys, electrical conductors, and aluminum paint also increased.

The Aluminum Industry, by J. D. Edwards, F. C. Frary, and Zay Jeffries, was an outstanding publication in 1930. This work is in two volumes; the first treats of aluminum and its production and the second of aluminum products and their fabrication. The authors are officials of the Aluminum Co. of America, use of whose records renders the publication highly authoritative. It contains a vast amount of information not published elsewhere.

WORLD PRODUCTION OF BAUXITE AND ALUMINUM

As yet definite figures on production of bauxite throughout the world in 1930 are not available. World production as compiled by the Bureau of Mines from official reports amounted to 2,149,000 metric tons in 1929, compared with 2,032,000 tons in 1928. The production in 1929 includes 1,369,000 tons (more than 63 per cent of the total) from Europe, 398,000 tons (nearly 19 per cent) from South America, and 372,000 tons (17 per cent) from North America. Production in 1929 from Asia and Australia amounted to less than 0.5 per cent of the total.

World production of bauxite, 1926–1930, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
Australia: Victoria		936	196	555	(1)
British Guiana [2]	189,101	163,454	168,077	188,123	121,536
France	508,129	655,000	636,000	666,300	608,415
Germany			6,860	7,256	(1)
Greece	2,320	4,300	300	6,280	(1)
Hungary	3,067	339,464	395,974	389,152	(1)
India, British	5,036	4,379	14,902	9,189	(1)
Italy	90,500	95,300	162,229	192,774	161,187
Rumania	715	1,706	653	926	(1)
Spain			181	975	323
Surinam (Dutch Guiana)	44,230	184,203	213,869	209,998	264,556
United Kingdom: Northern Ireland	(3)	5,394	2,322	2,359	(1)
United States	398,546	326,091	381,452	371,648	335,918
Yugoslavia	131,828	100,327	49,264	103,366	94,700
	1,379,000	1,881,000	2,032,000	2,149,000	(1)

[1] Data not available. [2] Exports. [3] Estimate included in total.

Aluminum was produced only in North America and Europe, a little more metal being furnished by the former than by the latter. North America contributed 138,790 metric tons and Europe 134,700 tons, a total of 273,490 tons in 1930, compared with 281,615 tons in 1929 and 256,473 tons in 1928.[4]

RANK OF COUNTRIES IN PRODUCTION OF ALUMINUM AND BAUXITE

Considering aluminum and bauxite production by countries the United States leads all others in production of the metal, and France leads in production of bauxite. Six countries supplied about 88 per cent of the total aluminum produced in the world in 1930; in order of output they are the United States, Canada, Germany, France, Switzerland, and Norway. Three countries—France, Hungary, and the United States—supplied 66 per cent of the total bauxite produced in 1929; four other countries—Dutch Guiana, Italy, British Guiana, and Yugoslavia—supplied 32 per cent. Of the 7 chief producers of bauxite and 6 chief producers of aluminum only 2 countries—the United States and France—appear in both groups, as the following table shows.

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[4] American Bureau of Metal Statistics, Year Book, 1930, p. 117.

Rank of countries in production of aluminum in 1930 and bauxite in 1929

Aluminum			Bauxite		
Rank	Country	Production in 1930 (per cent of world total)	Rank	Country	Production in 1929 (per cent of world total)
1	United States	37.99	1	France	31.01
2	Canada	12.76	2	Hungary	18.11
3	Germany	11.30	3	United States	17.30
4	France	10.60	4	Dutch Guiana	9.77
5	Switzerland	8.19	5	Italy	8.97
6	Norway	7.50	6	British Guiana	8.75
			7	Yugoslavia	4.81
	Other countries (England, Italy, Austria, and Spain)	11.66		Other countries	1.28
		100.00			100.00

NATURE OF BAUXITE

Aluminum is the most abundant metal in the earth's crust; in fact, the quantity is exceeded only by that of two other elements, oxygen and silicon. Throughout the world there is a great abundance of clays and other aluminous materials containing as much as 20 to 35 per cent of aluminum oxide, but such material, although theoretically a possible source of aluminum, is not likely to be utilized for commercial production of the metal as long as extensive deposits of bauxite containing 50 to 60 per cent of aluminum oxide remain available. Bauxite is therefore the only commercial ore of aluminum at present.

Bauxite is not a distinct mineral but a mixture of mineral substances, being usually a residuum of rock from which various constituents, especially silica, have been removed by natural leaching processes. Broadly speaking, rock in place that has been thus leached is called laterite; if it is sufficiently free from silica and if alumina predominates over other oxides of metals, it is called bauxite. Bauxite is relatively rare in comparison with the vast quantities of low-grade aluminous material available.

Typical bauxites now worked throughout the world contain less than 2 per cent silica, 10 to 30 per cent combined water, 55 to 65 per cent alumina, and 25 per cent to less than 1 per cent ferric oxide, together with 1 to 2 per cent titanium oxide. Bauxites of the United States and the Guianas are characterized by very high percentages of water, usually about 30 per cent; by a low percentage of ferric oxide, usually about 1 per cent; and by relatively high silica, usually about 2 per cent. The alumina averages about 60 per cent in the ores of the United States and somewhat higher in the ores of Guiana.

It has been estimated that about 75 per cent of the bauxite output is consumed in the production of aluminum, the remainder being consumed chiefly in the manufacture of cement, refractories, and abrasives and for the filtering of oil.

MAKING ALUMINUM FROM BAUXITE

Aluminum is not smelted directly from the bauxite. It must first be extracted from the ore as an aluminum compound from which the metal aluminum is reduced in an electrolytic furnace, some of it being refined further.

Alumina (Al_2O_3), the aluminum compound used commercially for production of the metal, may be extracted from bauxite by several chemical processes, the Bayer alkaline process being used most extensively. This process readily eliminates iron and titanium but dissolves some silica, hence the necessity for low silica content in bauxite for alkaline treatment. The acid processes are less effective in eliminating iron and titanium but usually do not dissolve the silica in the bauxite. "Purified alumina suitable for the production of aluminum usually contains a total of less than 0.1 per cent of the oxides of iron, silicon, and titanium and is a highly refined product. The purification is a relatively expensive process."[5]

As approximately 2 tons of high-grade bauxite is required to make 1 ton of alumina, of which about 2 tons must be reduced to make 1 ton of metal, production of 1 ton of aluminum consumes about 4 tons of bauxite (usually somewhat less).

The economic status of aluminum is somewhat similar to that of nickel, as the industry is largely in the hands of a few great producers. Production is therefore readily correlated with demand, and prices remain relatively constant. In the last five years the world production of aluminum has expanded 40 per cent and domestic production 58 per cent.

Many new uses for aluminum have been developed in recent years, and relatively high prices for tin and copper have encouraged intensive research to effect substitution of aluminum for those metals. Aluminum is now employed extensively wherever lightness, durability, and strength are important. During 1929 new blooming and structural mills were completed at Massena, N.Y., to enlarge facilities for the output of strong alloys of aluminum. In 1930 a new plant for a similar type of work was under construction at Alcoa, Tenn. The size of structural elements made of aluminum and its alloys is increasing rapidly, due to more extended use of these metals in the superstructures of buildings, in the building of railroad coaches, airplanes, and automobiles, and for other purposes.

BAUXITE

DOMESTIC PRODUCTION—IMPORTS AND EXPORTS

In 1930 the bauxite output of the United States was 330,612 long tons, valued at $1,928,297, compared with 365,777 tons, valued at $2,265,638, in 1929. The decrease in quantity amounts to 9.6 per cent; that in value to nearly 15 per cent. The decrease in output was much more than balanced, however, by an increase of 57,913 tons in net imports, compounded of 29,047 tons decrease in exports and 28,866 tons increase in imports. Imports of bauxite in 1930 aggregated 409,678 long tons, valued at $1,995,941, compared with 380,812 tons, valued at $1,753,840, in 1929, an increase of 7.6 per cent in quantity. Exports in 1930 amounted to 104,504 long tons, valued at $3,776,774, compared with 133,551 tons, valued at $3,926,283, in 1929, a decrease of nearly 22 per cent in quantity. The net imports in 1930 thus amounted to 305,174 tons, compared with 247,261 tons in 1929. The resulting total supply of bauxite in the United States in 1930 was 635,786 tons, compared with 613,038 tons in 1929; the net increase in supply was 22,748 tons or 3.7 per cent.

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[5] Edwards, Junius D., and Mason, Ralph B., Aluminum Production in Its Present-Day Aspects: Chem. and Met., vol. [illegible], No. 11, November, 1929, p. 674. (This is a valuable and succinct summary of processes.)

Bauxite produced in the United States, 1921–1930

Year	Georgia, Alabama, and Tennessee[1]		Arkansas		Total	
	Long tons	Value f. o. b. mine	Long tons	Value f. o. b. mine	Long tons	Value f. o. b. mine
1921	14,700	$134,400	124,850	$755,400	139,550	$889,800
1922	42,810	329,440	266,790	1,682,890	309,600	2,012,330
1923	28,810	176,030	493,880	2,980,580	522,690	3,156,610
1924	19,940	156,990	327,630	1,981,000	347,570	2,137,990
1925	20,220	109,800	296,320	1,878,450	316,540	1,988,250
1926	20,680	116,650	371,570	2,298,550	392,250	2,415,200
1927	17,110	95,920	303,830	1,892,860	320,940	1,988,780
1928	14,190	80,668	361,236	2,193,230	375,426	2,273,898
1929	14,723	84,480	351,054	2,181,158	365,777	2,265,638
1930	15,339	104,908	315,273	1,823,389	330,612	1,928,297

[1] No production from Alabama in 1924, 1925, and 1926, and none from Tennessee in 1927, 1929, and 1930.

Bauxite imported into and exported from the United States, 1921–1930

Year	Imports for consumption		Exports (including bauxite concentrates)	
	Long tons	Value	Long tons	Value
1921	27,587	$164,589	5,942	$488,785
1922	23,656	93,805	19,617	961,208
1923	119,020	593,882	78,560	3,380,486
1924	201,974	909,493	77,065	3,979,832
1925	353,696	1,549,120	78,633	4,134,455
1926	281,644	1,187,497	87,770	4,741,260
1927	356,580	1,572,236	121,858	7,800,491
1928	350,111	1,534,498	112,984	5,210,912
1929	380,812	1,753,840	133,551	3,926,283
1930	409,678	1,995,941	104,504	3,776,774

Bauxite was produced in Alabama in 1930 from the Eufaula and "Lennig" mines in Barbour County and the Davis Hill No. 3 mine in Henry County. Shipments were 33 per cent less than in 1929; 79 per cent of the ore shipped was taken by the chemical industry and the rest by the abrasive industry.

Bauxite was produced in Georgia in 1930 at the Hatton and Easterlin mines in Sumter County. Shipments were 136 per cent more than in 1929; nearly all of this ore was taken by the chemical industry.

Bauxite was produced in Arkansas in 1930 at four mines—the Sweet Home and Dixie No. 2 mines in Pulaski County and the Bauxite and Superior mines in Saline County. Total shipments from Arkansas amounted to 315,273 long tons, a decrease of 10 per cent from 1929. The main production originated in the Saline County field, where shipments decreased 5 per cent. The mines in Pulaski County shipped 30 per cent less in 1930 than in 1929. The shipments from Arkansas were mainly for use in the aluminum industry, followed in order by the abrasive, chemical, and refractory industries.

TOTAL BAUXITE PRODUCTION OF THE UNITED STATES

The first bauxite produced in the United States was obtained in 1889 from deposits in the north Georgia field, and in 1891 bauxite was first produced from the Alabama deposits. Practically all the bauxite mined in the United States until 1899 came from these two States. In 1896 the first shipments were made from Arkansas deposits, but it was not until 1900 that their influence was felt. In 1907 bauxite from the Tennessee deposits was first shipped. The total production of bauxite recorded in Mineral Resources from 1889 to 1930, inclusive, is 7,830,399 long tons.

ECONOMIC SETTING OF DOMESTIC PRODUCTION

Domestic production of bauxite is limited by competition from the high-grade bauxite of British and Dutch Guiana, which can be readily shipped by water direct to North Atlantic ports for consumption by the chemical industries or by way of New Orleans and the Mississippi River by water or rail to the interior as far as St. Louis for treatment and reshipment of concentrates. This fact limits the mining of domestic bauxite to deposits where the conditions for exploitation, including quality of ore and costs of mining and shipment, are exceptionally favorable. A substantial part of the high-grade domestic bauxite reserves is owned by aluminum-manufacturing interests which tend to relate their own domestic production to general plans that include provision for imports from Guiana and maintenance of domestic bauxite supply at an amount determined by plant capacity for treatment.

The international character of the aluminum industry is emphasized further by the utilization of available Canadian water power by manufacturing interests for the production of alumina and aluminum. In 1930 nearly 91 per cent of the exports, described officially as "Bauxite and other aluminum ores and concentrates," from the United States went to Canada by way of the Great Lakes ports, almost all the rest having gone to Norway by way of New Orleans. In 1929 more than 94 per cent of such exports went to Canada and practically all the rest to Norway. Although Canada is not a producer of bauxite the manufacture of aluminum from raw materials imported from the United States has been carried on at Shawinigan Falls, Quebec, since 1903. Recently a new plant was built at Arvida, near Lake St. John, on the upper reaches of the Saguenay River.

> Both plants still use bauxite from the United States but it is expected that the Arvida plant, because of its accessibility to tidewater, will be able to bring in its raw materials more cheaply by water from British Guiana than is now possible by rail from United States mines.[6]

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[6] Dominion Bureau of Statistics, Mineral Production of Canada, 1928, p. 147.

The report cited shows furthermore (p. 148) that imports from the United States prior to 1928 consisted of alumina which was extracted at East St. Louis partly from foreign ore barged up the Mississippi from New Orleans. In 1928 Canadian imports of alumina dropped to 33,000 tons from 126,000 tons in 1927. This drop in Canadian imports of alumina was more than compensated for by Canadian importation of 130,000 tons of bauxite, a considerable part of which originated in Guiana. The Canadian report of alumina imported in 1929 is not yet available, but exports from the United States to Canada in that year exceeded 125,000 tons—a return to the basis of 1927.[7]

PRICE

As the largest consumers of bauxite in the United States are also the chief producers, and consumers who do not own deposits usually contract for their supplies for considerable periods, in order to assure an adequate supply, only a small market exists for new or sporadic production. The price of bauxite at mines or shipping points in 1930, as reported by producers, ranged from $5 to $14.12 a ton; the average price reported by all producers for the year was $5.83 a ton f. o. b. mines, that for Arkansas bauxite being $5.78 and for Alabama bauxite $7.67. Consumers, on the other hand, report prices for domestic bauxite that average considerably more. The price at consuming plant varies with the distance from mines, and transportation charges are the chief element in the difference in cost reported.

The price of bauxite is quoted in the Engineering and Mining Journal. "No. 1 chemical ore, crushed and dried, 55 to 58 per cent Al_2O_3 and 1.5 to 2.5 per cent Fe_2O_3," was quoted at $6.50 to $8.25 a long ton f. o. b. Alabama and Arkansas mines. Dalmatian low-silica bauxite was quoted at $4.50 to $6.50 a metric ton c. i. f. Atlantic ports; Istrian, $5.50 to $7; and French red bauxite, $6 to $8.[8]

Under the tariff act of 1930 crude bauxite is dutiable at the rate of $1 a ton, and alumina hydrate or refined bauxite at one-half cent a pound. (See par. 6, Schedule 1, and par. 207, Schedule 2.)

MARKET

Bauxite finds its chief market east of the Mississippi River and is sold chiefly to the manufacturers of aluminum, abrasives, commercial chemicals, and refractories. The manufacturers of alumina cements are largely supplied by imported bauxite. High-alumina (diaspore) clays produced in Missouri are now used in the manufacture of refractories and are sold according to their alumina content; three grades containing 55, 65, and 70 per cent of alumina (Al_2O_3) are regularly handled. Information on production will be found in the Mineral Resources report on Clay.

Some of the makers of refractories and of aluminum chemicals are using increasing quantities of clay as a crude material in place of bauxite.

Domestic bauxite was reported as sold in 1930 to the consuming industries shown in the table that follows. In comparison with 1929 sales of domestic bauxite to the aluminum industry increased 4 per cent, but those to manufacturers of aluminum salts decreased 22 per cent and those to makers of artificial abrasives decreased 18 per cent.

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[7] Foreign Commerce and Navigation of the United States, 1929, vol. 1, p. 132.

[8] Engineering and Mining Journal, vols. 129 and 130, 1930.

The large increase in 1929 in the amount of bauxite sold for cement and refractories manufacture was not maintained in 1930, as the quantity fell from 6,626 tons in 1929 to 937 tons in 1930. The reason for this decrease is obscure.

For a number of years it has been impossible to give separate statistics showing the output of either artificial aluminous abrasives or refractories; however, some measure of the combined output of these materials made from bauxite may be had from the quantity of bauxite sold to manufacturers, as indicated in the following table:

Domestic bauxite sold by producers to industries in the United States, 1921–1930, in long tons

Year	Aluminum	Chemical	Abrasive [1]	Cement and refractory [1]	Total
1921	91,700	41,000	6,850		139,550
1922	211,560	78,540	19,270	230	309,600
1923	380,520	68,870	72,830	470	522,690
1924	225,780	54,870	66,400	520	347,570
1925	173,040	67,420	73,720	260	314,440
1926	241,850	77,960	72,710	230	392,250
1927	186,490	62,410	71,790	250	320,940
1928	218,398	83,992	72,931	105	375,426
1929	172,807	86,419	99,925	6,626	365,777
1930	179,869	67,690	82,116	937	330,612

[1] Small quantity of bauxite sold to makers of refractories probably included under "Abrasive."

Value of aluminum and aluminum salts made from bauxite in the United States, 1921–1930

Year	New aluminum	Aluminum salts	Year	New aluminum	Aluminum salts
1921	$10,900,000	$7,547,200	1926	$37,583,000	$13,202,010
1922	13,622,000	8,813,000	1927	39,266,000	14,288,430
1923	28,305,000	8,987,400	1928	47,899,000	13,956,264
1924	37,607,000	9,301,400	1929	51,864,000	11,677,728
1925	36,430,000	13,155,790	1930	50,961,000	10,245,063

BAUXITE PRODUCERS IN THE UNITED STATES IN 1930

Wm. J. Crouch Mining Co., Adairsville, Ga.
Dixie Bauxite Co., Sweet Home, Ark.
Benjamin Easterlin, Americus, Ga.
Kalbfleisch Corporation, 535 Fifth Avenue, New York, N. Y.
Charles Lennig & Co. (Inc.), 222 West Washington Square, Philadelphia, Pa.
Republic Mining & Manufacturing Co., 230 Park Avenue, New York, N. Y.

CONSUMERS OF BAUXITE IN THE UNITED STATES IN 1930

Alcoa Ore Co., East St. Louis, Ill.
Atlas Portland Cement Co., 25 Broadway, New York, N. Y.
Birmingham Water Works Co., Birmingham, Ala.
Board of Public Utilities, Kansas City, Kans.
Bureau of Water Supply, Baltimore, Md.
Calumet Chemical Co., Joliet, Ill.

The Carborundum Co., Niagara Falls, N. Y.
City of Columbus Purification Works, Columbus, Ohio.
Dalecarlia Filter Plant, Washington, D. C.
Exolon Co., Blasdell, N. Y.
General Abrasive Co., Niagara Falls, N. Y.
General Chemical Co., 40 Rector Street, New York, N. Y.
General Refractories Co., 106 South Sixteenth Street, Philadelphia, Pa.
Grasselli Chemical Co., Cleveland, Ohio.
Gulf Refining Co., Frick Building Annex, Pittsburgh, Pa.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
William F. Jobbins (Inc.), Aurora, Ill.
Kalbfleisch Corporation, 535 Fifth Avenue, New York, N. Y.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Charles Lennig & Co. (Inc.), 222 West Washington Square, Philadelphia, Pa.
Louisiana Chemical Co., Bastrop, La.
Massillon Stone & Fire Brick Co., Massillon, Ohio.
Merrimac Chemical Co., 148 State Street, Boston, Mass.
Metropolitan Utilities District, Omaha, Nebr.
Norton Co., Worcester, Mass. (also Niagara, Falls, N. Y.).
Paper Makers Chemical Co., Kalamazoo, Mich.
Passaic Valley Water Commission, 158 Ellison Street, Paterson, N. J.
Pennsylvania Salt Manufacturing Co., Widener Building, Philadelphia, Pa.
Sacramento Filtration Works, Sacramento, Calif.
Stauffer Chemical Co., 624 California Street, San Francisco, Calif.
Water Department of Kansas City, Kansas City, Mo.
Welch Chemical Co., 8 East Long Street, Columbus, Ohio.

BENEFICIATION OF BAUXITE

An outstanding development in beneficiation of Arkansas bauxite is reported by the Republic Mining & Manufacturing Co., owner of important mines at Bauxite, Ark. This company completed in 1930 a pilot plant for treatment of bauxite below ordinary shipping grade in which a process determined by a year of preliminary laboratory research is now being tried out. The object of the milling is a reduction of the amount of silica contained in some of the bauxite ore. The process consists essentially of washing ore suitably crushed and screened to permit classification with a classifier of the rake type. A personal communication to the author states: "Preliminary results have been favorable and if these are confirmed by operations over a substantial period of time a considerable tonnage of relatively low-grade material, which has not been merchantable, will be made available as ore."

GEOMAGNETIC SURVEY OF CENTRAL ARKANSAS BAUXITE REGION

Bulletin 5[9] of the Geological Survey of Arkansas, published in 1930, gives a map of a subsurface ellipsoidal area of nepheline syenite which links the bauxite-bearing syenite outcrops in Pulaski County with those of similar outcrops 10 miles southwest in Saline County. The conclusion is reached that "the potential bauxite-bearing region in central Arkansas can be extended to include an area of at least 165 square miles." The additional area of syenite shown lies chiefly to the east of that already indicated by outcrops and is part of an underlying igneous area "nearly 400 square miles in extent, fringed with plugs and dikes of basic igneous rock." The character and extent of these areas had already been indicated by geological studies of the surface and by drilling, but these had not made possible definite mapping of the boundaries of the areas.

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[9] Stearn, Noel H., A Geomagnetic Survey of the Bauxite Region in Central Arkansas: Geol. Survey of Arkansas, Bull. 5, 1930, 16 pp.

Known bauxite of this locality was formed through disintegration of syenite exposed at the surface, which was subsequently covered by Tertiary sediments. It is by no means probable, however, that the whole of the syenite area was exposed, and much of the bauxite formed must have been subject to erosion. It therefore remains to be seen whether the mapping of the subsurface syenite area will result in material increase of bauxite reserves already demonstrated. So far the largest and best deposits have been found at very moderate depth below the present surface.

ALUMINUM

DOMESTIC PRODUCTION—IMPORTS AND EXPORTS

New aluminum produced in the United States in 1930 amounted to 229,035,000 pounds (114,518 short tons), valued at $50,961,000, an increase of 2 per cent in quantity but a decrease of 2 per cent in total value compared with 1929. According to statistics collected by J. P. Dunlop, of the Bureau of Mines, 38,600 short tons of secondary aluminum were recovered in 1930—19,700 tons as metal and 18,900 tons as the aluminum content of casting alloys. The combined domestic production of new aluminum and of secondary aluminum recovered as metal and in alloys thus amounted to 153,118 tons, 75 per cent of the total being new metal and 25 per cent secondary or recovered material.

Aluminum produced in the United States, 1921–1930

Year	Primary metal		Secondary metal	
	Pounds	Value	Pounds	Value[1]
1921	55,000,000	$10,906,000	17,800,000	$3,775,400
1922	74,000,000	13,622,000	32,580,000	6,085,900
1923	129,000,000	28,305,000	42,600,000	10,824,600
1924	150,000,000	37,607,000	54,000,000	14,596,200
1925	140,000,000	36,430,000	88,000,000	24,816,000
1926	145,000,000	37,583,000	88,400,000	23,868,000
1927	160,000,000	39,266,000	92,400,000	23,469,600
1928	210,000,000	47,899,000	95,600,000	22,848,400
1929	225,000,000	51,864,000	96,800,000	23,135,200
1930	229,035,000	50,961,000	77,200,000	17,177,000

[1] 1921–1929: Value of secondary aluminum based on average price at New York as given by American Metal Market; 1930: Based on average price as reported to Bureau of Mines.

Aluminum imports decreased more than 51 per cent in total value—from $10,860,009 in 1929 to $5,285,584 in 1930; exports decreased nearly 11 per cent—from $7,971,085 in 1929 to $7,121,854 in 1930.

Imports of aluminum metal, scrap, alloy, etc., decreased 50 per cent in quantity in 1930 compared with 1929; imports of plates, sheets, bars, circles, disks, etc., increased 117 per cent in quantity; imports of hollow ware decreased 18 per cent in both quantity and value; and imports of aluminum powders and foil decreased 20 per cent in quantity.

Aluminum imported for consumption in the United States, 1929 and 1930, by classes

Class	1929		1930	
	Pounds	Value	Pounds	Value
Crude and semicrude:				
Crude form, scrap, alloy, etc	50,858,523	$9,925,855	25,412,742	$4,674,815
Plates, sheets, bars, strips, rods, coils, and blanks	20,450	7,578	48,437	14,706
Circles, disks, rectangles, and squares	1,850	1,290		
	50,880,823	9,934,723	25,461,179	4,689,521
Manufactures:				
Leaf (5½ by 5½ inches)	(1)	39,521	(1)	36,905
Bronze powder and powdered foil[2]	377,040	138,182	467,146	155,258
Foil less than 0.006 inch thick	1,141,718	568,587	740,918	277,390
Table, kitchen, and hospital utensils and other similar hollow ware	126,100	70,295	102,829	57,961
Other manufactures	(3)	108,701	(3)	68,549
		925,286		596,063
Grand total		10,860,009		5,285,584

[1] 1929: 29,093,849 leaves; 1930: 27,154,316 leaves; equivalent in pounds not recorded.
[2] Import classification beginning June 18, 1930; prior to change in tariff classification read "Powder, powdered foil."
[3] Quantity not recorded.

Aluminum imported for consumption in the United States, 1921–1930

Year	Crude and semicrude[1]		Manufactures of[2]	Total value
	Pounds	Value		
1921	32,559,017	$7,627,508	$1,262,283	$8,889,791
1922	43,891,933	8,286,819	1,408,193	9,695,012
1923	42,476,789	8,316,816	425,747	8,742,563
1924	31,809,941	6,859,785	285,251	7,145,036
1925	41,997,178	9,805,645	301,122	10,106,767
1926	71,391,717	16,421,905	357,472	16,779,377
1927	62,575,222	13,316,986	884,992	14,201,978
1928	38,847,007	8,057,107	816,368	8,873,475
1929	50,880,823	9,934,723	925,286	10,860,009
1930	25,461,179	4,689,521	596,063	5,285,584

[1] Includes crude aluminum, plates, sheets, wire, etc.
[2] Includes aluminum leaf, kitchen utensils, and all other manufactures of aluminum.

Exports of crude and semicrude aluminum increased nearly 2 per cent in quantity in 1930 compared with 1929; exports of tubes, moldings, castings, and other shapes decreased 24 per cent in quantity.

Domestic aluminum exported from the United States, 1929 and 1930, by classes

Class	1929		1930	
	Pounds	Value	Pounds	Value
Crude and semicrude:				
Ingots, scrap, and alloys	613,366	$117,345	607,608	$84,278
Plates, sheets, bars, strips, and rods	16,418,751	4,032,194	16,721,903	3,831,304
	17,032,117	4,149,539	17,329,511	3,915,582
Manufactures:				
Tubes, moldings, castings, and other shapes	2,466,508	738,376	1,864,308	598,949
Table, kitchen, and hospital utensils	(1)	708,467	(1)	560,267
Other manufactures of aluminum	(1)	2,374,703	(1)	2,047,056
	(1)	3,821,546	(1)	3,206,272
Grand total	(1)	7,971,085	(1)	7,121,854

[1] Quantity not recorded for table, kitchen, and hospital utensils and other manufactures.

Aluminum and manufactures of aluminum exported from the United States, 1921–1930

Year	Crude and semicrude [1]		Manufactures of	Total value
	Pounds	Value		
1921	2,196,378	$801,075	$2,307,782	$3,108,857
1922	4,347,020	1,127,460	[2] 1,708,656	2,836,116
1923	5,539,671	1,517,562	[2] 2,053,977	3,571,539
1924	6,343,512	1,632,315	[2] 2,540,075	4,172,390
1925	12,642,064	3,365,815	[2] 2,691,256	6,057,071
1926	7,634,171	2,135,087	[3] 2,317,216	4,452,303
1927	14,522,660	3,478,649	[3] 2,828,772	6,307,421
1928	15,728,281	3,758,728	[3] 3,132,762	6,891,490
1929	17,052,117	4,149,539	[3] 3,821,546	7,971,085
1930	17,329,511	3,915,582	[3] 3,206,272	7,121,854

[1] Includes ingots, metal and alloys, plates and sheets, etc.

[2] Represents value of 4,544,949 pounds in 1922, 5,402,634 pounds in 1923, 6,783,240 pounds in 1924, and 6,463,192 pounds in 1925 of tubes, moldings, castings, and other shapes, table, kitchen, or hospital utensils, and other manufactures. Figures of quantity not available prior to 1922.

[3] Tubes, moldings, castings, and other shapes exported amounted to 2,115,274 pounds in 1926, 1,529,615 pounds in 1927, 1,095,957 pounds in 1928, 2,466,508 pounds in 1929, and 1,864,308 pounds in 1930; figures for quantity of table, kitchen, or hospital utensils, and other manufactures exported are not recorded.

From the preceding tables of imports and exports in 1930 it appears that the total imports for which the weights are recorded amounted to 13,386 short tons and the total exports to 9,597 tons. The excess of imports over exports thus accounted for amounts to 3,789 tons, indicating an approximate total supply of 118,307 tons of aluminum, other than domestic secondary, for domestic consumption.

PRICE

According to the Engineering and Mining Journal the domestic price of new aluminum ingot 99 per cent pure was 24.3 cents a pound until June 26, 1930, when a new quotation of 23.3 cents a pound was announced; this price prevailed for the rest of the year. A corresponding reduction from 23.9 cents to 22.9 cents a pound for metal 98 to 99 per cent pure was made in the outside market.

USES AND CONSUMPTION OF ALUMINUM

Certain established uses for aluminum showed decreases in 1930 in demand for the metal but these were more than offset by gains in other uses, particularly in strong aluminum alloy materials, in electrical conductors, and in paint. New uses have been developed and improvements made in older applications largely as a result of industrial research.

Decreased consumption of aluminum in 1930 was especially noticeable in the automobile and aircraft branches of the transportation industry. Other branches of transportation, however, and certain other fields of consumption showed increases in demand for the metal, notwithstanding the fact that these same outlets suffered a general curtailment of production.

Builders of truck and bus bodies, for example, incorporated aluminum strength members in body frames, in addition to low-stressed parts, such as paneling and roofing. Tank trucks for gasoline haulage and trucks for heavy commodities, such as coal and sand, as well as those for lighter merchandise, now utilize aluminum in the form of strong alloy sheets and structural shapes, heat treated to develop maximum physical properties.

The introduction in 1930 of a new piston alloy of low expansion coefficient further insures the market for aluminum pistons. It is reported that more than 75 per cent of the automobile passenger car manufacturers in this country are at present using aluminum-alloy pistons.

Large structural shapes of strong aluminum alloys, available in sizes up to 85 feet in length and 14 inches in depth, were produced for use in railroad and railway car construction, for trucks and buses, and for such units as cranes and hoists.

Strong aluminum-alloy wire was introduced during the year by a prominent fence manufacturer as a new material for woven fence and barbed wire. Another manufacturer started the production of aluminum window screening. In both instances durability is the prime advantage of aluminum. The resistance of aluminum to atmospheric corrosion is also responsible for a steady increase in the use of the metal as a roofing and sheet-metal material and for an even sharper increase in its use as an ornamental metal on the exteriors of office and public buildings. Aluminum spandrels, window frames and sills, skylights, finials, grilles, balustrades, store fronts, and other ornamental metal applications, both exterior and interior, satisfy the architect's demand for a durable white metal that is strong but easily fabricated. Notable quantities of aluminum were used for building purposes in all large cities in 1930. Most spectacular was the case of the Empire State Building in New York, in the construction of which a total of approximately 850,000 pounds of aluminum was used.

In connection with architectural uses the progress made in aluminum furniture is of interest. During 1930 a total of seven furniture and office equipment manufacturers listed aluminum chairs as standard sales products.

The use of aluminum paint has expanded rapidly both in the industrial and in the building field. An important development in 1930 was the completion of tests of aluminum paint as a priming coat on wood, applied to the lumber before shipment from the mill. This mill priming is applied by machinery and gives a protective coating on both front and back surfaces of the lumber, as well as on sides and ends. As a step in the economical protection of wood against moisture penetration this new process and its possibilities are of broad interest in the production of siding and building specialties made of wood.

The consumption of the metal in aluminum cable and bus bar accounts each year for an average of about 16 per cent of the country's production of aluminum. Sales in 1930 were largely in the form of bare stranded cable with a core of steel for transmission lines. During the year, however, a complete line of insulated aluminum wires and cables was launched by a large manufacturer as a supplement to similar products of copper. This development extends the use of aluminum to include insulated cables for underground network systems, automobile starter cable, aviation and automobile wiring systems, and other wire and cable products.

Electroplating on aluminum and chemical or electrochemical processes of coloring aluminum have been commercialized. These finishes are extending the use of the metal by providing a change or modification of its characteristic color. Chromium-plated aluminum hub caps for automobiles illustrate how aluminum is surfaced to match in finish other hardware parts of the car.

Heavy aluminum foil or thin sheets of aluminum have been found to offer a protective coating for oil tank cars, pipe lines, storage tanks, and similar structures. This aluminum foil, applied like wall paper, with proper adhesives, is used to protect the underlying surface against sulphur fumes or general atmospheric corrosion and to furnish a radiant-heat reflecting surface. On an oil or gasoline container the lasting brightness of the foil absorbs little solar heat and reduces evaporation losses by keeping the temperature of the volatile contents at a minimum.

The approximate consumption of virgin domestic aluminum by industries is indicated as follows:

	Per cent
Transportation (land, air, and water)	38
Electrical conductor	16
Cooking utensil	14
Machinery (electrical appliances, etc.)	9
Iron and steel metallurgy	8
Building	4
Foundry and metal working	4
Chemical	2
Food products	1
Miscellaneous	4
	100

ALUMINUM SALTS

Manufacturers of aluminum salts reported a consumption of 125,382 long tons of bauxite in 1930, having an average value of $12.06 a ton at the plant, compared with 142,344 tons in 1929, with an average value of $13.44 a ton. Of the bauxite consumed in 1930, 67,724 tons was domestic bauxite and 57,658 tons was imported bauxite. An unrecorded quantity of high-alumina clay, 4,547 short tons of alumina hydrate, and some aluminum sulphate were also used in the preparation of aluminum salts. These figures do not include the bauxite made into alumina and sodium aluminate as a preliminary step in the manufacture of aluminum. Neither do the figures in the following table include the alumina and sodium aluminate made as a preliminary step in the manufacture of aluminum.

Aluminum salts produced in the United States, 1929 and 1930

Salt	1929				1930			
	Number of producers reporting	Short tons	Value		Number of producers reporting	Short tons	Value	
			Total	Average			Total	Average
Alum:								
Ammonia	5	5,108	$286,592	$56	5	4,076	$228,986	$56
Sodium	3	15,005	855,754	57	3	14,787	802,981	54
Potash	3	6,304	254,290	40	3	1,923	104,818	55
Other	1							
Aluminum chloride:								
Liquid	4	2,399	127,935	53	3	3,288	90,731	28
Crystal	3	365	43,148	118	3	583	53,363	92
Anhydrous	3	13,787	1,429,743	104	3	11,664	1,208,091	104
Aluminum sulphate:								
Commercial—								
General	11	319,736	7,589,244	24	10	305,059	6,649,066	22
Municipal	6	8,190	126,550	15	9	10,300	172,671	17
Iron-free	6	20,441	731,732	36	7	18,177	642,247	35
Other aluminum salts and hydrate	[1] 5	2,758	232,740		[1] 4	3,194	292,109	
		394,093	11,677,728			373,051	10,245,063	

[1] 1929: 2 producers each of alumina and sodium aluminate and 1 producer of aluminum stearate; 1930: 3 producers of alumina and 1 producer of sodium aluminate.

Aluminum salts produced in, imported into, and exported from the United States, 1921–1930

Year	Domestic production		Imports		Exports (aluminum sulphate) [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1921	184,813	$7,547,184	1,009	$45,963	(2)	(2)
1922	281,480	8,812,987	2,889	116,971	13,225	$388,447
1923	289,904	8,987,421	2,318	120,663	17,805	505,732
1924	302,190	9,301,410	2,523	113,075	16,012	407,749
1925	335,480	13,155,790	3,205	140,518	20,756	505,537
1926	373,695	13,202,010	2,937	140,994	22,031	521,123
1927	378,770	14,288,430	1,845	83,288	21,128	491,317
1928	386,905	13,990,264	1,425	68,096	[1] 22,713	[1] 552,342
1929	394,093	11,677,728	1,912	86,411	[1] 26,588	[1] 607,757
1930	373,051	10,245,063	2,058	90,472	[1] 25,255	[1] 573,234

[1] Also "other aluminum compounds" as follows: 1928, 418 short tons, valued at $85,809; 1929, 275 tons, $65,458; 1930, 1,009 tons, $194,503; not separately classified prior to 1928.

[2] Exports not separately shown prior to 1922.

ALUMINOUS ABRASIVES AND REFRACTORIES

The use of aluminous abrasives and high-alumina refractories, although generally characterized by expansion in recent years, declined in 1930. Makers of artificial abrasives took 82,116 long tons of domestic bauxite in 1930. Makers of refractories took 42,711 short tons of high-alumina (diaspore) clay in 1930.

FOREIGN BAUXITE AND ALUMINUM INDUSTRIES [10]

NORTH AMERICA

CANADA

Canada produced 34,900 metric tons of aluminum in 1930, compared with 42,000 tons in 1929, 40,000 tons in 1928, 38,500 tons in 1927, and 17,800 tons in 1926. Exports of aluminum [11] amounted to 33,099 metric tons in 1929, compared with 18,414 tons in 1928. The destination of exports in 1929 was as follows: United States, 39 per cent; Japan, 24 per cent; United Kingdom, 17 per cent; other countries, 20 per cent. Corresponding data for 1930 are not yet available.

Reduction works at Shawinigan Falls and Arvida, in Quebec, are owned by the Aluminum Co. of Canada, a subsidiary of Aluminium (Ltd.). The latter was created in 1928 to take over the Aluminum Co. of Canada together with practically all foreign interests owned by the Aluminum Co. of America. The stock of Aluminium (Ltd.) was distributed as a stock dividend to the stockholders of the Aluminum Co. of America.

The Aluminum Co. of Canada was expected to complete the first unit of its own hydroelectric plant at Chute-à-Caron in February,

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[10] Unless otherwise stated, figures for foreign production of bauxite are those shown in the world table on p. 152, compiled from official reports; those for aluminum are taken from the yearbooks of the American Bureau of Metal Statistics, Imperial Institute, or Metallgesellschaft. Exports and imports are taken from reports of the Imperial Institute, Metallgesellschaft, or Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

[11] Metallgesellschaft, Stat. Zusammenst., 1920–1929, p. 28.

1931.[12] This unit will generate 250,000 hp. daily for use at the Arvida plant; the ultimate daily capacity of the plant will be 700,000 hp. The Arvida plant, consisting of a refinery for the treatment of bauxite, an electrode plant, and a reduction plant, will have a larger output of aluminum than any other plant in the world. Most of its production is expected to be required at Detroit for use in automobile manufacture.

It is reported[13] that during 1930 Aluminium (Ltd.) maintained its rate of production and sold all it produced and also a part of previously accumulated stocks, although at a lower average price than that of 1929.

The Sodalumina Chemical Corporation (Ltd.) of Canada[14] expects to undertake the extraction of alumina, soda ash, hydrochloric acid, silica, etc., from clay deposits by the Keogh process.

Canada.—*Production, imports, and exports of aluminum and imports of bauxite, alumina, and cryolite, 1926–1930, in metric tons*

Year	Aluminum			Bauxite and alumina imports[3]	Cryolite imports[3]
	Production[1]	Imports[2]	Exports[2]		
1926	17,800	436	11,420	65,837	2,904
1927	38,500	506	23,542	114,865	1,110
1928	40,000	633	18,414	148,558	3,142
1929	42,000	386	33,099	129,449	2,178
1930	34,900	(4)	(4)	(4)	(4)

[1] American Bureau of Metal Statistics, Year Book, 1930, p. 117.
[2] Metallgesellschaft, 1920–1929, p 28.
[3] Imperial Institute, Statistical Summary, 1925–1927, 1926–1928, and 1927–1929.
[4] Data not available.

GREENLAND

Greenland, the only source of natural cryolite, exported 29,780 metric tons in 1929, compared with 25,935 tons in 1928. Official Danish reports show 21,398 metric tons imported by Denmark in 1929. Imports into the United States for that year amounted to 7,903 metric tons. The cryolite sent to Copenhagen is refined there and reexported to other countries.

SOUTH AMERICA

BRITISH GUIANA

Unofficial figures indicate a production from British Guiana in 1930 of 120,083 long tons (122,010 metric tons) of bauxite; exports are officially reported as 119,616 long tons (121,536 metric tons). The production amounted to 220,129 metric tons in 1929, compared with 200,891 tons in 1928 and 192,984 tons in 1927. Exports amounted to 188,123 metric tons in 1929, compared with 168,077 tons in 1928 and 163,454 tons in 1927.

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[12] Wall Street Journal, vol. 95, No. 122, May 27, 1930, p. 17.
[13] American Metal Market, vol. 38, No. 70, Apr. 14, 1931, p. 4.
[14] Bureau of Foreign and Domestic Commerce, World Trade Notes, vol. 4, No. 4, Jan. 27, 1930.

British Guiana.—*Production and exports of bauxite, 1926–1930, in metric tons*

Year	Production[1]	Exports	Year	Production[1]	Exports
1926	222,516	189,101	1929	220,129	188,123
1927	192,984	163,454	1930	[2] 122,010	121,536
1928	200,891	168,077			

[1] Imperial Institute, Statistical Summary (annual). [2] Information from unofficial source.

The principal company operating in British Guiana is the Demerara Bauxite Co. (Ltd.), a subsidiary of Aluminium (Ltd.), but the British & Colonial Bauxite Co. (Ltd.) obtained a lease in 1929 on bauxite deposits up the Demerara River, in the vicinity of Christianburg.[15] From the beginning of exploitation in 1915 to the end of 1929, the Demerara company had shipped about 1,160,000 long tons of bauxite. Washers and dryers are now used for beneficiating the ore by removal of silica above 3 per cent. The process yields a 70 per cent recovery.

The bauxite deposits are similar to those of Dutch Guiana, occurring in small hills that rise above the coastal plain 60 to 80 miles from the coast and near the Demerara and Berbice Rivers. Average analysis of shipments is said to be as follows:[16] 61 per cent Al_2O_3; 2.75 per cent SiO_2; 2.5 per cent Fe_2O_3; 2.75 per cent TiO_2; and 31 per cent combined water.

DUTCH GUIANA

Official figures indicate a production from Surinam (Dutch Guiana) in 1930 of 264,556 metric tons of bauxite and exports of 263,015 metric tons. Surinam produced 209,998 metric tons in 1929, compared with 213,869 tons in 1928, 184,203 tons in 1927, and 44,230 tons in 1926. Exports amounted to 215,795 metric tons in 1929, compared with 206,767 tons in 1928, 176,292 tons in 1927, and 46,454 tons in 1926.

Two important companies operate in Dutch Guiana—the Kalbfleisch Corporation and the Surinaamsche Bauxite Maatschappij (a subsidiary of the Aluminum Co. of America). In 1928 the latter shipped[17] nearly 190,000 tons of ore of all grades from its Moengo mine, which has a maximum plant capacity of about 200,000 tons annually. The ore deposits are near Paramaribo, along the Surinam, Cottica, and Coermotibo Rivers, extending from about 15 to 100 miles from the coast. They range in thickness from 10 or 12 feet in the south to as much as 50 feet in the north.

The ores of Dutch Guiana run about 59 per cent Al_2O_3, 2 per cent SiO_2, 6 per cent Fe_2O_3, 3 per cent TiO_2, and 30 per cent water (combined). They resemble the ores of Arkansas except that they contain less SiO_2.

EUROPE

AUSTRIA

There are two aluminum-reduction works in Austria—the Aluminium Industrie (Neuhausen) at Lend-Gastein and Elektrizitätswerke Stern und Hafferl, A. G., at Gmunden, Oberösterreich, also known as the "Aluminiumwerke Steeg."

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[15] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 249, June 8, 1929.
[16] Edwards, J. D., Frary, F. C., and Jeffries, Zay, Aluminum and Its Production: 1930, p. 111.
[17] Engineering and Mining Journal, vol. 128, No. 12, Sept. 21, 1929, pp. 460–463.

Austrian production of aluminum amounted to 3,500 metric tons in 1930, compared with 3,700 tons in 1929, 4,000 tons in 1928, 4,000 tons in 1927, and 3,000 tons in 1926. Exports[18] of aluminum amounted to 3,981 metric tons in 1929, compared with 4,038 tons in 1928, 4,243 tons in 1927, 3,575 tons in 1926, and 2,022 tons in 1925. Imports of aluminum amounted to less than 1,000 tons annually during this 5-year period. Exports went largely to Switzerland, Germany, Belgium, and Russia. Imports of aluminum oxide amounted to 8,100 metric tons in 1929, compared with 9,000 tons in 1928. In addition, about 2,000 tons of aluminum hydroxide is imported annually. Austrian reserves of raw materials are not large.

DENMARK

The aluminum industry of Denmark comprises importation of crude cryolite from Greenland for refining and exportation to other European countries. Imports of crude cryolite amounted to 21,398 metric tons in 1929, compared with 16,174 tons in 1928, 14,316 tons in 1927, 17,325 tons in 1926, and 22,424 tons in 1925. Exports of refined cryolite amounted to 18,120 metric tons in 1929, compared with 15,508 tons in 1928, 12,539 tons in 1927, 14,627 tons in 1926, and 17,425 tons in 1925.

Aluminous clays, 2 meters thick, averaging 32 to 36 per cent alumina and amounting to several million tons, have been found north of Amundsfjord, in Iceland.

FRANCE

It is reported[19] that the bauxite industry in the vicinity of Brignoles, which provides more than three-fourths of the bauxite produced in France, has suffered a severe decline since the middle of 1930. Several producers have closed down and others are operating at a curtailed rate. This reflects a general decline in the French aluminum industry due to the industrial depression.

France produced 29,000 metric tons of aluminum in 1930, compared with 29,000 tons in 1929, 26,539 tons in 1928, 25,042 tons in 1927, and 23,600 tons in 1926. Exports of aluminum amounted to 2,190 metric tons in 1929, 3,080 tons in 1928, 6,747 tons in 1927, 868 tons in 1926, and 2,138 tons in 1925. Imports amount to a few hundred tons annually. The consumption of aluminum in 1929 was estimated by Metallgesellschaft at 25,000 metric tons.

French production of bauxite amounted to 608,445 metric tons[20] in 1930, compared with 666,300 tons in 1929, 636,000 tons in 1928, and 655,000 tons in 1927. Exports of bauxite amounted to 213,799 metric tons in 1930, compared with 240,415 tons[21] in 1929, 250,755 tons in 1928, and 262,339 tons in 1927. Exports of hydrous alumina amounted to 35,400 metric tons in 1929, compared with 30,400 tons in 1928.

The French aluminum and bauxite industry is located chiefly on the east side of the Rhône Valley near the Alps and the boundaries of Switzerland and Italy. During recent years Var has been the center of bauxite production, followed by Hérault, Ariège, and

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[18] Statistik des auswärtigen Handels Oesterreichs, October-December, 1929.

[19] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 328, Mar. 7, 1931, p. 3.

[20] Echo des Mines, No. 3069, June 20, 1931, p. 505.

[21] Mining Journal, London, vol. 169, No. 4938, Apr. 12, 1930, p. 306.

Bouches-du-Rhône; in 1928 Var furnished 81 per cent and Hérault 16 per cent of the total.

As a result of successive consolidations only two great companies now produce aluminum in France. The Compagnie des Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue (popularly known as Pechiney) has alumina works at St. Auban, Salindres, and Gardanne; it has reduction works at 10 different points, determined chiefly by available power. The Société d'Electrochimie, d'Electrométallurgie et des Aciéries Electriques d'Ugine, with alumina works at La Barasse, has reduction works at three different points. Both these dominant producers join in a third company, Aluminium Français, which serves as their sales organization and as a fabricator of aluminum.

GERMANY

In 1930 the German aluminum industry was depressed. German production of aluminum amounted to 30,900 metric tons in 1930 and 32,700 tons in 1929. Metallgesellschaft estimates a consumption of 39,000 tons in 1929. Imports of bauxite[22] declined 22 per cent, from 386,971 metric tons in 1929 to 300,377 tons in 1930. France supplied 146,000 tons, Hungary 97,000 tons, Italy 72,000 tons, and Yugoslavia 68,000 tons in 1929. Aluminum production plants operated at about two-thirds capacity, and a prohibition[23] of imports of raw aluminum metal was replaced by a tariff of 25 marks per 100 kilos of raw metal. There was friction and price cutting between plants importing raw metal from Switzerland and German producers unable to sell their product, some adjustment being finally arranged under auspices of the Government.

Although Germany is said to have enough bauxite to supply its requirements for aluminum, if necessary, only a small production is made at present from the Vogelsberg and Osterburken mines; these mines produced 7,256 metric tons in 1929.

Alumina works are located at Lautawerk, Duisburg, Breslau, Bergheim, and Ludwigshafen and aluminum-reduction works at Lautawerk, Innwerk, Grevenbroich, Bitterfeld, and Rheinfelden. A considerable part of the electricity for German production of aluminum is generated from coal as cheap lignite is available.

GREECE

Deposits of bauxite are fairly widespread in the limestone regions of western Greece, and in recent years somewhat extended investigations have been made to ascertain the probable value of the deposits. Similar occurrences have been found on the islands of Kimolos, Seriphos, and Melos, where, according to Pliny, alum was made as early as the first century. The production of bauxite had declined to 300 metric tons in 1928, from 4,300 tons in 1927 and 2,320 tons in 1926. In 1929 production increased to 6,280 tons; figures for 1930 are not yet available.

Greek deposits have been acquired by the Otavi Minen und Eisenbahn Gesellschaft,[24] and in 1929 a joint holding company was formed,[25] in which the Otavi company joined equally with Vereinigte Aluminium Werke in Lautawerke and the Barlos Greek Bauxite Mines Co. The Barlos company has 17 valuable bauxite concessions at Distomon, Boeotia, Gulf of Corinth, Greece, four of which will be prepared for production.

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[22] Metal Bulletin, London, No. 1568, Feb. 13, 1931, p. 16.
[23] Mining Journal, London, vol. 70, No. 4954, Aug. 2, 1930, p. 631.
[24] Daily Metal Reporter (Int. Monthly Sec.), vol. 29, No. 54, March, 1929, p. 14.

HUNGARY

Hungary does not produce aluminum but produces much bauxite, of which it has extensive reserves, although the ore is not usually of high grade. Practically all that is produced is exported to Germany. It is reported unofficially[26] that only 92,000 metric tons of bauxite were produced in the first nine months of 1930. Hungary produced 389,152 metric tons of bauxite in 1929, compared with 395,974 tons in 1928 and 339,464 tons in 1927. Exports amounted to 100,549 metric tons in 1929, compared with 183,487 tons in 1928 and 228,504 tons in 1927. Bauxite exports to Germany amounted to 96,664 tons in 1929.

The bauxite deposits of Hungary are in the trans-Danube territory south and west of the Danube River. Several deposits in the Vertes Mountains near Gant, Zamoly, and Czakbereny are reported to have many millions of tons of ore in reserves.[27] These mines are connected at Bodajk with the Danube-Sabe-Adria Railway by an 18-kilometer branch road; systematic operation began in 1926. They are controlled by the Bauxite Trust, A. G., owned jointly by the Vereinigte Aluminium Werke, A. G., General Hungarian Coal Mining Co., Salgotariana Coal Co., and Otavi Minen und Eisenbahn Gesellschaft.

Recently, Hungarian deliveries to Germany declined, due to excessive accumulation of stock by the Vereinigte Aluminium Werke, which announced it would no longer take French ore but would meet its needs with Hungarian bauxite mined by the Bauxite Trust.[28]

In order to increase consumption of bauxite the Bauxite Trust, A. G., has been financing various aluminous cement projects[29] in Poland, Czechoslovakia, and Yugoslavia, and the Continental Bauxite Trust has confirmed a report[30] that it will support the construction in Hungary of an aluminum factory having a capacity of 1,600 tons a year.

The annual consumption of aluminum in Hungary is about 2,000 tons.

ITALY

Production of aluminum in Italy in 1930 increased to 8,000 metric tons,[31] but the outstanding event of the year for the industry was a decree[32] prohibiting importation of unmanufactured aluminum into Italy because of the construction of new aluminum plants in that country. At Aurelia near Rome[33] a plant is being built to manufacture aluminum from leucite with potash as a by-product. The plant will treat 20,000 tons of leucite a year, and it is planned to increase capacity to a million tons from which 30,000 tons of aluminum is expected to be made.

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[25] Engineering and Mining Journal, Aug. 18, 1929, p. 271.
[26] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 321, Jan. 10, 1931, p. 1.
[27] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 141, May 14, 1927.
[28] Daily Metal Reporter (Int. Monthly Sec.), vol. 30, No. 58, pt. 2, Mar. 25, 1930, p. 15.
[29] Daily Metal Reporter (Int. Monthly Sec.), vol. 30, pt. 2, Jan. 31, 1930, p. 15.
[30] Daily Metal Reporter (Int. Monthly Sec.), vol. 29, No. 204, Oct. 22, 1929, p. 15.
[31] Revista Minera, Metalurgica y de Ingenieria, vol. 82, No. 3265, May 24, 1931, p. 236.
[32] Engineering and Mining Journal, vol. 130, No. 9, Nov. 10, 1930, p. 500.
[33] Industrial and Engineering Chemistry, News Ed., vol. 8, No. 3, Feb. 10, 1930, p. 6.

Italy produced 161,187 metric tons of bauxite in 1930, compared with 192,774 tons in 1929, 162,229 tons in 1928, and 95,300 tons in 1927. Much of the output was exported, more than 71,000 tons going to Germany in 1929. Aluminum production amounted to 8,000 metric tons in 1930, compared with 7,373 tons in 1929, 3,618 tons in 1928, and 2,544 tons in 1927. Aluminum imports amounted to 2,386 metric tons in 1929 and exports to only 121 tons. The apparent consumption of aluminum in 1929 was thus about 9,600 tons.

In 1929 four companies were operating in Italy: Società dell' Alluminio Italiano, controlled by Aluminium (Ltd.) (subsidiary of Aluminum Co. of America), at Borgofranco (annual capacity 1,400 tons); Società Meriodionale di Elettricita (formerly Società di Elettricochimica, but now controlled by A. G. Aluminium Industrie Neuhausen), at Bussi, Aquila (annual capacity 1,000 tons); Società Anonima Veneta dell' Alluminio, at Porto-Maghera (annual capacity 3,000 tons); and Società Italiana dell' Alluminio (subsidiary of Società Montecatini), at Mori, Trentino (annual capacity 6,000 tons). The Otavi Minen und Eisenbahn Gesellschaft has been negotiating[34] with the Montecatini company regarding joint exploitation of the latter's idle properties. The Lautawerke Co. has a plant for the extraction of alumina by the Haglund process at the Montecatini works, but reports indicate that the process has not yet been perfected.

The Società Alluminio Veneto has announced plans to produce 20,000 tons of alumina, 6,000 tons of aluminum, and 6,000 tons of electrodes.[35]

Reserves of bauxite in Italy have been estimated[36] at 13,600,000 metric tons—8,100,000 tons in Istria and 5,500,000 in Abruzzi—having a content of 40 to 63 per cent Al_2O_3. Three of the leading Istrian producers are controlled by American concerns.

NORWAY

Norway produces no bauxite, but its water power has made it an important producer of aluminum from imported bauxite. Production of aluminum in 1930 amounted to 20,500 metric tons. In December, 1930, exports of aluminum had dropped to 844 metric tons, compared with 2,107 tons in the corresponding month of 1929. Total exports in 1930 amounted to 23,676 tons.[37]

The following table shows the imports of raw materials and the production and exports of aluminum from 1925 to 1930:

Norway.—*Imports of bauxite, alumina, and cryolite and production and exports of aluminum, 1925–1930, in metric tons*

Year	Bauxite and alumina imports	Cryolite imports	Aluminum	
			Production	Exports
1925	45,676	2,379	21,300	20,549
1926	45,067	2,152	24,400	22,131
1927	42,650	1,954	20,847	22,077
1928	52,636	2,385	24,779	16,842
1929	67,677	2,301	29,142	29,813
1930	(a)	(a)	20,500	23,676

[a] Data not available.

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[34] Daily Metal Reporter, Mar. 20, 1929, p. 14.

[35] Mining Journal, London, vol. 166, No. 4900, July 20, 1929, p. 597.

[36] Redecker, S. B., Cons. Rept. 329,797 (7,563), Feb. 15, 1930, pp. 8-10.

[37] Metal Bulletin, London, No. 1569, Feb. 17, 1931, p. 20.

The exports of aluminum in 1929 went to the United Kingdom (50 per cent), Russia (16 per cent), United States (15 per cent), Germany (6 per cent), Japan (5 per cent), Belgium (3 per cent), Sweden (2 per cent), and other countries (3 per cent). In 1930 the exports to the United Kingdom dropped to 38.6 per cent of the total and those to Russia increased to 26.6 per cent.

The principal companies operating aluminum-reduction works include the following:

1. Aktieselskapet Stangfjordens Elektrokemiske Fabriker, at Stangfjord (owned by the British Aluminium Co.) (400 tons).
2. Aktieselskapet Vigelands Brug, at Vigelands (owned by the British Aluminium Co.) (3,000 tons).
3. Det. Norske Nitridaktieselskab, at Eydehavn and Tyssedal (owned by Compagnie A. F. C., British Aluminium Co., and Aluminium (Ltd.) (annual capacity, 15,000 tons in 1929).
4. Norske Aluminium Co., at Höyanger (owned jointly by Norwegian interests and Aluminium (Ltd.), (annual capacity, 6,500 tons).
5. A. S. Haugvik Smelteverk, at Glomfjord (annual capacity, 8,000 tons).

Norway is fortunate in possessing hydroelectric power sites on excellent harbors. The first production of aluminum was made in 1908. The total rated annual capacity in 1930 was about 36,000 tons, of which the subsidiaries of Aluminium (Ltd.) produced a considerable part. The improvements now under way at various plants and the new plants at Kinsarwik and Glomfjord will increase the annual capacity to 65,000 tons.

RUMANIA

Rumania produced 926 metric tons of bauxite in 1929, compared with 653 tons in 1928, 1,706 tons in 1927, and 745 tons in 1926.

The Otavi Minen und Eisenbahn Gesellschaft has purchased bauxite properties in the Bihar Mountains of western Rumania.[38] These deposits are said to have from 2,000,000 to 10,000,000 tons of reserves in sight and possible extension to as much as 20,000,000 tons. The better grade of red ore runs 55.6 per cent Al_2O_3, 3 per cent SiO_2, 25.3 per cent Fe_2O_3, and 11 per cent moisture; a gray ore runs about 69 per cent Al_2O_3, 12 per cent SiO_2, 3 per cent Fe_2O_3, and 15 per cent water.

RUSSIA

It is reported [39] that in 1930 negotiations were in progress for cooperation of the French aluminum industry with the Russian aluminum works trust. Technical assistance of Russia by the French with exchange of patents, processes, etc., is contemplated. France will enjoy exclusive right to supply aluminum to Russia until Russian plants using French patents are in operation.

A committee has reported [40] upon an investigation of aluminum-ore deposits in the Zagliksk region of Azerbaijan, Caucasus. They find 78 million tons of ore from which 7½ million tons of aluminum may be obtained, "enough to supply all requirements of the Soviet Union." Such a relation between quantities of ore and aluminum expected from it would not suggest that the deposit is high grade.

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[38] Daily Metal Reporter (Int. Monthly Sec.), vol. 29, No. 54, March, 1929, p. 14.

[39] Metal Bulletin, London, No. 1585, Apr. 21, 1931, p. 16. Also Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 317, p. 6.

[40] Metal Bulletin, London, No. 1550, Dec. 9, 1930, p. 16.

In fact, there seems little assurance as yet of Soviet ability to found an aluminum industry of much importance. Reports from Russia generally convey an impression of vagueness with respect to essential factors, and there is much talk of new ways of utilizing other aluminous material than bauxite. No doubt this will eventually be accomplished somewhere, but successful transplantation of an industry from one country to another is usually effected not by the invention of new technology but by acceptance of established processes developed elsewhere.

Deposits of bauxite have been developed in the Tikhvin, Riazan, and Perm districts. The Soviet Government plans to use these deposits as a basis for the erection of aluminum-reduction works at Svanka, Dnieper, and Moscow. The three works will be under French technical supervision, both as to construction and operation.

The Tikhvin region has 15 deposits which have been drilled sufficiently to indicate more than 8,000,000 tons[41] of reserves. The ore lies in a blanket 1 to 10 meters thick and 5 to 20 meters below the surface; a substantial part of the ore runs as high as 71 per cent alumina.

Preliminary to erecting a reduction plant near the Dnieper power station[42] in the Ukraine the Russians have been experimenting with processes. As planned, the plant will have an annual capacity of 10,000 to 15,000 tons of aluminum. The new plant on the Volkhov[43] near Svanka will have an annual capacity of 5,000 tons. The Moscow plant is expected to be chiefly a fabrication plant.

As Russian consumption of aluminum is about 6,000 tons annually[44] the new plants, when finished, would provide an exportable surplus.

Imports of aluminum into Russia[45] amounted to 5,132 metric tons in 1929, 5,793 tons in 1928, 2,840 tons in 1927,[46] and 1,796 tons in 1926.

SPAIN

Spain produced 975 metric tons of bauxite in 1929, compared with 181 tons in 1928. Its annual consumption of aluminum amounts to about 1,500 metric tons.

Spain is the most recent country to enter the aluminum-producing field; the only works are at Sabiñánigo, Province of Huesca. The plant is operated by the Aluminio Español, S. A.; it has a rated capacity of 1,200 tons a year. Production of aluminum amounted to 1,000 metric tons in both 1929 and 1930. Imports of alumina amounted to 2,500 metric tons in 1929.

SWITZERLAND

Switzerland does not produce bauxite but because of its water power produces considerable aluminum. The production of aluminum in 1930 was 22,400 metric tons, compared with 20,700 tons in 1929. In 1930 the aluminum industry of Switzerland was moderately depressed; it was greatly disturbed in the latter part of the year. Although the Neuhausen works continued normal production[47] some other operations were gradually suspended. Flow of raw aluminum to Germany was interrupted by a German embargo,[48] later replaced by an import duty. The Singen works in Germany, allied with Swiss producers, is now allowed to import 3,600 tons a year of Swiss aluminum provided it buys 3,000 tons a year of German aluminum. The flow of Swiss aluminum to England increased, but Switzerland raised its tariff on aluminum to protect the Swiss industry from dumping.[49] In 1930 imports of aluminum from Canada amounted to 1,553 tons, whereas imports from all other countries amounted to only 413 tons.[50]

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[41] Anderson, R. J., The Russian Bauxite Deposits: Min. Mag., London, vol. 41, July and August, 1929, pp. 9–15 and 83–92.

[42] American Metal Market, vol. 37, No. 76, Apr. 18, 1930, p. 4.

[43] Daily Metal Reporter (Int. Monthly Sec.), vol. 30, pt. 2, Jan. 21, 1930, p. 12.

[44] Mining Journal, London, vol. 166, No. 4902, July 27, 1929, p. 618.

[45] Daily Metal Reporter, vol. 30, pt. 2, No. 97, May 20, 1930, p. 15.

[46] Ann. Rept. on the Mineral Resources of U. S. S. R., 1926–27, Leningrad, 1928.

The following table gives statistics of the Swiss aluminum industry for 1925 to 1929.

Switzerland.—*Imports of alumina and production, exports, and consumption of aluminum, 1925–1929, in metric tons*

Year	Alumina imports	Aluminum		
		Production	Exports	Consumption
1925	([1])	21,000	13,862	7,500
1926	31,685	21,000	15,443	5,800
1927	40,323	20,000	13,393	7,000
1928	45,544	19,900	15,045	6,000
1929	42,201	20,700	13,212	8,000
Annual average	([1])	20,520	14,191	6,860

[1] Data not available.

Exports of aluminum from Switzerland in 1929 went to Germany (26 per cent), United Kingdom (21 per cent), United States (14 per cent), Japan (14 per cent), Belgium (10 per cent), Italy (6 per cent), and other countries (9 per cent).

The Swiss aluminum-reduction plants include:

1. Aluminium Industrie, A. G., or Société Anonyme pour l'Industrie de l'Aluminium, with plants at Neuhausen and Chippis (Neuhausen is just west of Lake Constance and Chippis is in southwest-central Switzerland). The latter is the more important.
2. Fabrique d'Aluminium Martigny, S. A., at Martigny-Bourg, in the Canton of Valais (on the French border west and south of Chippis works) (annual production about 1,800 tons).

UNITED KINGDOM

The only bauxite produced in the United Kingdom comes from Northern Ireland, near Belfast, at Larne Harbor, County Antrim. This source, however, has not been able to compete successfully with foreign ores. The average annual production from 1925 to 1929, inclusive, amounted to about 4,000 tons, the output in 1929 being 2,359 metric tons. In the middle of 1930 the British aluminum industry began to be affected by the industrial depression, although less acutely than other metal industries.[51] Production of aluminum in 1930 amounted to 19,400 metric tons, compared with 13,900 tons in

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[47] Daily Metal Reporter (Int. Monthly Sec.), December, 1930, p. 33.
[48] Metal Bulletin, London, No. 1565, Feb. 3, 1931, p. 8.
[49] American Metal Market, vol. 37, No. 239, p. 4.
[50] Hukill, Geo. R. Swiss Aluminum Industry: Consular Rept., Apr. 27, 1931.
[51] Daily Metal Reporter (Monthly Supplement), No. 11, May, 1931, p. 10.

1929. Imports of aluminum in 1930 amounted to 18,397 tons,[52] compared with 22,647 tons in 1929; exports in 1930 amounted to 4,124 tons.

British aluminum statistics for 1925 to 1929 are summarized in the following tables:

United Kingdom.—*Imports and exports of aluminum raw materials, 1925–1929, in metric tons*

	1925	1926	1927	1928	1929
Imports:					
Alumina	54	692	109	1,077	924
Bauxite	76,051	64,391	90,474	111,262	123,109
Cryolite	1,578	1,211	1,183	1,572	1,742
Exports: Alumina	12,894	13,109	11,598	15,702	20,916

United Kingdom.—*Production, imports, exports, and consumption of crude aluminum, 1925–1929, in metric tons*

	1925	1926	1927	1928	1929
Production	9,700	7,300	7,900	10,700	13,900
Imports	10,223	12,179	15,398	13,583	22,647
	19,923	19,479	23,298	24,283	36,547
Exports	3,777	4,175	4,985	5,983	5,728
Consumption	16,100	15,300	18,300	18,300	30,800

British imports of aluminum in 1929 came from: Norway, 64 per cent; Canada, 20 per cent; Germany, 5 per cent; Switzerland, 4 per cent; United States, 3 per cent; Belgium, 2 per cent; and other countries, 2 per cent. Bauxite was obtained chiefly from France.

The principal companies operating alumina plants include:

1. British Aluminium Co. (Ltd.), at Larne Harbor, County Antrim, Ireland, and at Burnt Island, Fifeshire, Scotland.
2. International Aluminium Co. (Ltd.) (owned by Aluminium Co. (Ltd.)), at Hebburn, Newcastle-on-Tyne, England.

The main aluminum-reduction plants are as follows:

1. British Aluminium Co. (Ltd.), at Kinlochleven, Argyllshire, Scotland, and at Foyers, Invernessshire, Scotland.
2. North British Aluminium Co. (Ltd.) (owned by British Aluminium Co. (Ltd.), at Fort William, Invernessshire, Scotland. Here early in 1930 the first 53,000-hp. unit of the Lochaber hydroelectric plant was completed; 120,000 hp. will be developed ultimately.[53]
3. Aluminium Corporation (Ltd.), at Dolgarrog Sidings, near Llanrwst, North Wales.

In addition, Aluminium (Ltd.) controls the Northern Aluminium Co., the Aluminium Casting Co. (Ltd.), and the Aluminium Rolling Works, at Banbury.

YUGOSLAVIA

Yugoslavia produced 94,700 metric tons of bauxite in 1930, compared with 103,366 tons in 1929, 49,264 tons in 1928, 100,327 tons in 1927, and 131,828 tons in 1926. About 70,000 tons was exported to Germany in 1929.

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[52] Metal Bulletin, London, No. 1560, Jan. 16, 1931, p. 9.

[53] Canadian Mining Journal, vol. 51, No. 50, Dec. 12, 1930, p. 1204.

The chief deposits occur in Dalmatia; the bauxites average 57 per cent Al_2O_3, 1 to 2 per cent SiO_2, 24 per cent Fe_2O_3, 3.8 to 4.2 per cent TiO_2, and 12 per cent combined water. Lesser deposits are found in Carniola, Croatia, Herzegovina, Slovenia, and Montenegro. Reserves are said to total 50,000,000 tons, averaging 53 to 56 per cent Al_2O_3.[54]

French, German, and American companies have important holdings in Yugoslavia.

Phosphates Tunisiens, a French company, plans to increase the size of the Gubavica hydroelectric plant from 30,000 to 100,000 horsepower[55] and to erect a cement and aluminum works in the neighborhood of the deposits.

A German company[56] is erecting a new aluminum works at Mostar in Herzegovina.

ASIA

INDIA

India produced 9,189 metric tons of bauxite in 1929, compared with 14,902 tons in 1928 (11,346 tons from the Kaira district in Bombay and 3,556 tons from the Jubbulpore district in the Central Provinces), 4,379 tons in 1927, 5,036 tons in 1926, and 10,232 tons in 1925.

Aluminous (bauxite) deposits of consequence occur on the Baihir plateau in the Balagat district and in the vicinity of Katni in the Jubbulpore district, both in the Central Provinces. Good bauxite has been found in the laterite plateau in the western part of Chota Nagpur and in Sarguja (Bihar and Orissa) in the Satara district (Bombay), and in various parts of Madras Presidency. The Balagat bauxites have the following range of composition:

	Per cent
Alumina[57]	51. 62–58. 83
Silica	. 05– 2. 65
Ferric oxide	2. 70–10. 58
Titanium dioxide	6. 22–13. 76
Combined water	22. 76–30. 76
Moisture	. 40– 1. 14

JAPAN

Japan imports aluminum from other countries, chiefly from the United States; imports amounted to 11,473 metric tons in 1930, 11,894 tons in 1929, 9,168 tons in 1928, and 5,980 tons in 1927. Japan also imported from 500 to 1,000 tons of cryolite in 1929, but no production of aluminum has been reported. Japan's aluminum exports[58] amounted to 695 metric tons in 1930, 411 tons in 1929, and 166 tons in 1928.

In 1930 the establishment of an aluminum plant in Japan with Government support was being considered, and it has since been reported[59] that such a plant will be constructed on the Yalu River in Chosen; its annual capacity will be 10,000 tons.

The principal consumer of aluminum is the Sumitomo Electric Wire Works; this company uses American aluminum. A recent report[60] indicates that some of the Japanese aluminum-consuming companies have entered into an agreement to purchase their entire supply from and sell their products to British, French, German, and Swiss manufacturers. These companies include the Mitsubishi, Nichizu, and Furukawa trading and manufacturing concerns.

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[54] Davis, L. A., Bauxite Resources of Yugoslavia. Commerce Repts., Aug. 20, 1928, p. 490.
[55] American Metal Market, vol. 36, No. 78, Apr. 23, 1929, p. 4.
[56] Mining Journal, London, vol. 171, No. 4963, Oct. 4, 1930, p. 788.
[57] Content after calcination is 71.2 to 80.8 per cent Al_2O_3.
[58] Commerce Reports, No. 23, June 8, 1931, p. 614.
[59] Metal Industry, vol. 29, No. 5, May, 1931 p. 226.

AFRICA

FRENCH MOROCCO

Bauxite found in French Morocco has been described as follows:[61]

> Considerable interest is shown by the German aluminum industry in newly discovered bauxite deposits in French Morocco. As reported from Marrakesch, the deposits are situated in the Atlas Mountains, and it is estimated from top layers alone 20,000,000 tons of bauxite can be obtained. The mineral has a large alumina content, estimated at 70 per cent, and numerous water falls in the vicinity can furnish water power for the mining operations.

GOLD COAST

Bauxite, or aluminum hydrate, with certain impurities is found over portions of Gold Coast Colony and Ashanti, as a cap from a few feet to more than 50 feet in thickness on the summits of several mountains. The ores are of fairly high grade. The most important deposits are those of the Mount Ejuanema Kwahu district, estimated to have about 4,000,000 tons, and the Sefwi Bekwai district, having about 33,300,000 tons.[62] The Ejuanema deposit is 1½ miles in a direct line from Nkawkaw railway station, which is 111 miles from the port of Accra or 249 miles from the port of Sekondi, via Kumasi. The Sefwi Bekwai deposits are about 55 miles nortwest of Dunkwa, a station on the Sekondi-Kumasi Railway 100 miles from Sekondi. Average analyses of 198 specimens from Mount Ejuanema and of 55 specimens from Mount Supirri, Sefwi, are reported as follows:

	Mount Ejuanema	Mount Supirri
SiO_2	0.87	1.88
Al_2O_3	60.66	55.77
Fe_2O_3	9.27	10.30
TiO_2	1.94	1.12
H_2O	26.80	30.69

During 1928 a large deposit of bauxite was discovered[63] 4 to 5 miles west of Kumasi, 18 miles northeast of Bibiani, at the end of a proposed Western Province Railway in the Yenahin district; the deposit is alleged to contain 180,000,000 tons of good ore. Bauxite deposits have been located in the Pusu Pusu River, Kibi district, in Akim, and small deposits at Atiwa Range, Sajumase.

Although the economic value of these Gold Coast deposits has not been demonstrated and the quantity of bauxite reported for the Yenahin district seems almost fantastic, it seems probable that the

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[60] Metal Bulletin, London, No. 1475, Mar. 7, 1930, p. 10.

[61] Claiborne, H. C., Developments in the German Aluminum Industry: Commerce Repts., Mar. 26, 1928, p. 817.

[62] American Metal Market, Large Bauxite Deposits of Gold Coast: Dec. 9, 1927.

[63] Mining Journal, London, vol. 164, No. 4882, Mar. 16, 1929, p. 200.

Gold Coast may be counted upon to provide reserves of substantial character for the future.

OCEANIA

AUSTRALIA

Bauxite deposits have been found 60 miles southwest of Gladstone, at Crows Nest near Toowoomba, and at Cooranga station in the Gaynah district, Queensland, and numerous high-iron bauxite deposits are known in New South Wales. Aluminous clays, alunite, and bauxitic clays have been found in other sections of Australia. Production has been small and has come chiefly from Victoria which produced 555 metric tons of bauxite in 1929, compared with 196 tons in 1928 and 936 tons in 1927.

TUNGSTEN [1]

By Frank L. Hess [2]

CONTENTS

	Page
The year 1930 in the United States	179
Arizona	180
California	182
Colorado	183
Montana	183
Nevada	183
Washington	184
Imports	184
Changes in duties on tungsten	186
Markets	186
Metallurgy	189
The year 1930 in other countries	192
China	193
British Malaya	195
Bolivia	196
India (Burma)	197
Portugal	198
Tasmania	198
Consumption	198
Bibliography	201

ILLUSTRATION

Figure 2. Production and prices of tungsten concentrates in the United States, 1898–1930; world production, 1905–1930; and exports from China, 1914–1930 ... 181

THE YEAR 1930 IN THE UNITED STATES

The sales of tungsten concentrates produced in the United States again dropped in 1930, amounting to an equivalent of 702 short tons, carrying 60 per cent tungsten trioxide (WO_3), as compared with 830 tons in 1929. Sales of concentrates produced in the United States during the past 10 years are shown in the following table:

Concentrated tungsten ores (reduced to equivalent of 60 per cent WO_3) produced in the United States, sold in 1921–1930, and average price per unit [1]

Year	Short tons	Value	Average price per unit	Year	Short tons	Value	Average price per unit
1923	241	$144,600	[2] $10.00	1927	1,164	$724,000	$10.37
1924	[3] 565	[3] 287,000	8.47	1928	1,208	753,900	10.40
1925	1,191	755,500	10.57	1929	830	654,000	13.13
1926	1,382	920,400	11.10	1930	702	509,000	12.09

[1] No sales reported for 1921 and 1922.
[2] The output of 1923 was made by one company only, which sold to its owners at a price considerably above the market.
[3] Includes 191 tons produced in 1919, sold in 1924 for $87,000.

Of the sales in 1930 from domestic production 647 short tons were scheelite, and most of the remaining 55 tons were ferberite from Boulder County, Colo. A little wolframite was produced from Washington and Arizona and a little huebnerite from Nevada. The larger part of the scheelite was obtained from contact metamorphic deposits in Nevada and California, and smaller parts were from placers and veins in California and veins in Montana. At the close of the year 525 short tons of concentrates, equivalent to 560 tons carrying 60 per cent WO_3, were unsold.

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[1] Work on manuscript completed July, 1931.

[2] Statistics on domestic production prepared by H. W. Davis and figures on foreign production compiled by L. M. Jones, both of the Bureau of Mines. Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The production of tungsten concentrates in the United States, as indicated by sales or shipments, from 1898 to 1930; the world output from 1905 to 1930; and the exports from the principal producing country, China, from 1914 to 1930, are shown in Figure 2. The range of prices for each year is shown by three lines indicating the high, low, and average prices, respectively. The duties on tungsten in ore, prevailing since September 22, 1922, are also shown.

Arizona.—The output of concentrates from Arizona in 1930 was small and was confined to wolframite produced by lessees on the property of Lawler & Wood in Yavapai County 40 miles west of Prescott.

The Boriana Mining Co., which in 1929 took over the claims operated during the Great War by the Yucca Tungsten Mining Co. (a subsidiary of the York Metal & Alloys Co.) and adjoining claims in the Hualpai Mountains 17 or 18 miles northeast of Yucca, spent 1929 and 1930 in driving a haulage tunnel about 1,500 feet long, running raises and crosscuts, and drilling for water. The construction of a mill was started; it was expected to be in operation during the spring of 1931. The company is a subsidiary of the Stoody Co., of Whittier, Calif., manufacturer of alloys from which to make hard edges on oil-well drills and for similar purposes.

The vein is gray quartz carrying wolframite, scheelite, chalcopyrite, a little fluorite, less molybdenite, and here and there flakes of mica. It lies between folia of a soapy-feeling mica schist standing from an angle of 68° to vertical with a strike of N. 40° E. Like all veins in such rock it alternately swells and pinches. In certain places the vein incloses slabs of schist and forms as many as eight bands 2½ to 3 inches thick. The tenor of the ore seems to be unaffected by thickening or thinning of the vein. On the middle level of the Yucca Tungsten Mining Co.'s workings there was apparently about as much chalcopyrite as combined wolframite and scheelite. In the upper part of the vein the weathering of the chalcopyrite had set free copper-bearing solutions which attacked the scheelite and changed part of it to cuprotungstite ($CuWO_4+2H_2O$).

The "Tungsten Reef" or "Gold Reef" in the Huachuca Mountains south of Fort Huachuca was examined by one of the large consuming companies but was not taken over. The "reef" is a large quartz vein which lies between schists near the top of the range and has a dip of only about 15°. It is as much as 15 feet thick, and several acres have been laid bare by weathering. Here and there scheelite is found, and the deposit was mined under the high prices of the Great War. It is said that the quartz carries a little gold. The scheelite is distributed through the quartz so sparsely that a mill run was required to sample the vein properly, and a small mill was erected for the purpose.

In July the tungsten veins at Las Guigas, 65 miles south of Tucson, which were among the earliest tungsten deposits located in this country but which have heretofore yielded small production, were bought by the Tungsten Alloys Corporation, of 201 Devonshire Street, Boston. The tungsten mineral is said to be largely huebnerite, but in part wolframite, and is in quartz veins cutting

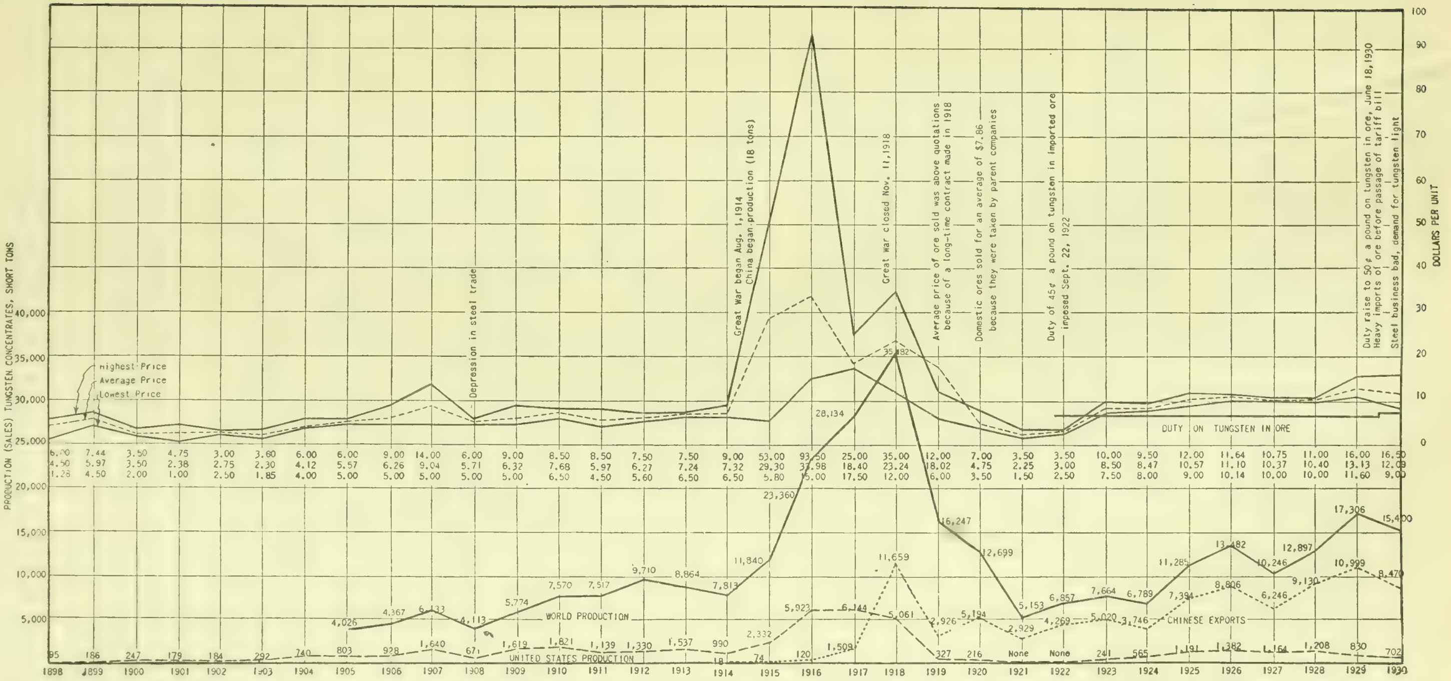

FIGURE 2.—Production and prices of tungsten concentrates in the United States, 1898–1930; world production, 1905–1930; and exports from China, 1914–1930

granites. Buildings for staff and employees, an assay office, a mine plant, and a concentrator with a daily capacity of 30 tons of ore, which can readily be expanded to 50 tons, have been constructed. The deposits were actively developed below ground, and the property was ready to produce concentrates early in 1931.

Some work was done by the Tungsten Production Co. (Inc.) in the Huachuca Mountains and on the King claims in the Little Dragoon Mountains 14 miles northeast of Benson.

The E. C. O'Brien & Co. mill at Globe did very little work during 1930.

California.—The Atolia Mining Co. was again the principal operator in tungsten in California. For some time the company has been milling the dumps from its mines, and all dump material that could be milled at a profit was finished during the year.

The placer in the débris southeast of the mill was worked all year. Its operation is a real accomplishment in mining because the material gives only about 2 pounds of concentrates, carrying 70 per cent WO_3, per ton; water supplies have always been short and expensive, either having been brought by rail 42 miles from Hinkley or pumped from small local supplies, and the gravel is hauled to the washing plant in trucks. About 2 cents in gold per ton of gravel is caught on an amalgamated plate, 8 feet by 3 feet.

Some ore is developed in the lowest level of the East Union mine, which has been the most extensive mine on the property, but work in the mine was stopped during the year.

The following note on the Kennedy tungsten mine near Posey is taken from the California Division of Mines report, Mining in California, October, 1930, pages 464–465:

> J. H. Kennedy, Posey (Jack Ranch); W. A. Trout and M. G. Brumley, of Los Angeles, owners. This mine is located 2 miles southeast of Jack Ranch, or 39 miles southeast of Porterville. Elevation, about 4,700 feet. Holdings comprise three claims: Broad Horn, Big Bear, and Evelyn. Timber: Oak and mahogany.
>
> Frank Ellis had prospected this property prior to Mr. Kennedy's development, which began in July, 1929. In April, 1930, actual work was started or the property and at the time of visit, July, 1930, a mill was almost completed. The ore occurs as scheelite in a garnetiferous gangue, between a granite footwall and a schist and blue-limestone hanging wall. The deposit strikes northwest-southeast, dipping westerly.
>
> Development consists of a 75-foot tunnel crosscutting the vein and a 32-foot drift on the outcrop. At a depth of 15 feet there is a 40-foot drift. About 500 feet has been proven on the surface. The ore is to be trammed from the mine down to a 50-ton storage bin at the mill, just below the mine. Equipment consists of a grizzly, 60-ton Universal crusher, 20-ton Hammon ball mill, two Myers service tables for desliming, and two 16-foot Standard Overstrom tables. A 2-inch pipe, 2,500 feet long, is used to pump water up to the mine. Water is secured at 60 feet, and a Fairbanks-Morse pump jack, Rumsey (5 by 6) Booster Triplex, and a 10-horsepower Fairbanks-Morse engine are used in pumping. About 10 men are to be employed.
>
> Another tungsten claim, the Anita May, with about 140 feet of tunnel, is located below the above property.

Some scheelite concentrates were produced by Cooper Shapley and associates at Round Valley near Bishop from very low-grade contact metamorphic deposits and by A. E. Beauregard from similar but richer ore near Laws.

The Pine Creek tungsten property was examined by a consuming company but was not operated during the year.

Colorado.—The Wolf Tongue Mining Co. made an encouraging discovery of ore on its Cold Spring claim and mined ore which was held over the end of the year. The only shipment made was a small quantity of very high-grade ore. The Clipper Tungsten Co., George Cowdery, George W. Teal, and the Tungsten Production Co. (Inc.) mined and sold ferberite ores or concentrates during the year. A number of lessees produced ores from several properties, and the Mann Ore Milling Co. purchased and concentrated ferberite and wolframite ores.

Much of the ferberite is so finely divided and distributed through hard, tough " bone " (fine-grained quartz) that concentration to high percentages is very difficult, even with high losses, so that concentrates of comparatively low tenor, ranging as low as 31 per cent WO_3, were placed on the market, although some concentrates contained as much as 67 per cent WO_3. With concentrates of the higher content the losses in milling are very high, unless veins lined with peculiarly high-grade crusts of ferberite are mined or unless the concentrates are a high-grade jig product and lower-grade fractions are made from the same ore.

Heretofore, prospecting for tungsten has been done by the time-honored method, with hand-hammer drill and dynamite, but William Loach, manager of the Wolf Tongue Mining Co., has been prospecting with a core drill in which one of the tungsten carbide alloys was used in place of diamonds. Gneiss and granite were drilled as cheaply as with diamonds and other rocks much more cheaply and with considerable satisfaction.

Montana.—The Jardine Mining Co. produced a shipment of scheelite concentrates from its gold-bearing arsenopyritic quartz veins. White arsenic, gold, and scheelite have all been produced from the mine. The tungsten production of 1930 was from a new ore body discovered during the year. A small roasting plant for removing arsenic from the scheelite concentrates was erected.

Nevada.—The Nevada-Massachusetts Co. near Mill City has for a number of years been the largest producer of tungsten ores in the United States. The deposits are tactite (contact-metamorphosed limestone) formed by the intrusion of quartz monzonite into the limestone. The limestone is only 3 to 5 feet thick and has been greatly deformed and broken. The fragments are of many sizes, many degrees of metamorphism; the introduction of scheelite, as would be expected, has been uneven. The two main bodies of ore are in fragments of the limestone which stand on edge and are surprisingly large for such thin beds. One, known as the " Sutton," averages 3 feet in thickness; the other, the " Stank," averages 4½ feet. Ott F. Heizer, superintendent of the mine, contributed two much appreciated papers on the company's work for publication by the United States Bureau of Mines. They are: Methods and Costs of Concentrating Tungsten Ore at the Nevada-Massachusetts Mill, Mill City, Nev. (Information Circular 6280, 10 pp.); and Methods and Cost of Mining Tungsten Ore at the Nevada-Massachusetts Co. Mines, Mill City, Nev. (Information Circular 6284, 13 pp.). Both are obtainable without cost from the Section of Publications, Bureau of Mines, Washington, D. C.

The Nevada-Massachusetts Co. is the successor of the Pacific Tungsten Co. and has bought the adjacent property of the Nevada-

Humboldt Tungsten Mines Co. Heizer shows that the tungsten trioxide (WO_3) content of the ore had dropped from 1.85 per cent in the mine of the Pacific Tungsten Co. and 1.5 per cent in the mine of the Nevada-Humboldt Tungsten Mines Co. in earlier years to an average of 0.96 per cent in 1928. To the end of 1928, 147,510 short tons of ore, carrying 1,661.7 tons of WO_3, or an average of 1.13 per cent WO_3, had been mined and milled. Heizer states in his papers that the present tenor of the ore is 1.10 per cent of scheelite, which is equivalent to 0.887 per cent WO_3.

The workings have reached a depth of 730 feet in the Stank shaft and of 800 feet on the Humboldt property, and the ore extends unbrokenly to that depth. These are depths which, especially for such thin limestone beds, anyone familiar with tactite deposits would have been hesitant to prophesy. For comparison, attention may be called to the large Pine Creek tactite deposit in thick limestone 20 miles northwest of Bishop, Calif., where an adit was driven through the limestone to cut the deposit 400 feet below the outcrop, but when the adit had reached a point under the outcrop it was found necessary to raise nearly 300 feet before the deposit was reached.

The company also operates the Wagner claims on a part of the "Silver Dyke," a broad netted quartz vein carrying shoots of scheelite and more than 3 miles long. There is a very limited supply of water in a deep, rough gulch close at hand, and rights have been required to the springs at Sodaville, a short distance south of Mina, and about 7 miles from the mine. The mill was rebuilt. Owing to the lack of demand for tungsten concentrates the mine was operated only a short time during the year.

A third property controlled by the company is a scheelite deposit in limestone near Quartz Mountain, on the one hundred and eighteenth meridian between 35 and 40 miles a little east of north from Luning. No concentrates were produced during 1930. The company also acquired the Ragged Top claims on tactite deposits 8 miles north of Toulon siding. These claims were operated for a time during the Great War by the H. M. Byllesby Co. Toulon is on the north side of the Humboldt Sink, where water can be obtained in wells, and it is intended to erect a mill there.

The Tungsten Production Co. (Inc.) made some concentrates at its plant in the Nightingale Mountains. The claims are 50 miles northwest of Lovelock and are located on very low-grade tactite deposits. C. B. Jacobs produced some scheelite in the Osceola district 45 miles east of Ely, and Perry & Corlett produced a small quantity of huebnerite concentrates near Ione.

Development work was done on tactite at a number of other localities, but no concentrates were made.

Washington.—The American Tungsten Co. produced a small quantity of wolframite from the Exodus claims at Deer Trail, Stevens County, which before the Great War had been worked for wolframite by the Germania Mining & Milling Co. James Keeth produced some high-grade hand-worked wolframite concentrates from his claims near Deer Trail.

IMPORTS

Imports of tungsten and tungsten-bearing materials during the past 10 years are shown in the following table.

Tungsten ore, ferrotungsten and tungsten metal, tungsten alloys, and tungsten chemicals imported for consumption in the United States, 1921–1930 [1]

Year	Tungsten ore and concentrates [1]		Tungsten metal		Combinations containing tungsten or tungsten carbide (W content)		Tungstic acid and other compounds of tungsten, not specially provided for (W content)		Tungsten and ferrotungsten, tungsten chemicals, powder, and acid [1]		Ferrochromium-tungsten, chromium-tungsten, and chromium-cobalt-tungsten (W content)		Tungsten-nickel and other alloys of tungsten, not specially provided for (W content)		Total tungsten contained in imported materials
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds
1921	3, 227, 840	$276, 757	(3)	(3)	(3)	(3)	(3)	(3)	507, 206	$180, 371	--------	--------	--------	--------	(2)
1922:															
Jan. 1–Sept. 21	3, 301, 760	279, 190							1,037,069	380, 732	--------	--------	--------	--------	(2)
Duty effective Sept. 22	45 cents per pound on contained W								60 cents per pound and 25 per centum ad valorem on contained W		60 cents per pound and 25 per centum ad valorem on contained W		60 cents per pound and 25 per centum ad valorem on contained W		
Sept. 22–Dec. 31	--------	--------							30, 876	$13, 254	--------	--------	885	$741	31, 761
1923	--------	--------							78, 972	25, 907	--------	--------	49	2, 258	79, 021
1924	--------	--------							132, 987	46, 156	8, 800	$2, 702	71	536	141, 858
1925	854, 059	$206, 326							839, 194	316, 454	396	352	--------	--------	1, 693, 649
1926	2, 534, 636	566, 996							330, 365	116, 879	18, 795	7, 822	71	417	2, 883, 867
1927	2, 170, 657	540, 409							27, 272	9, 777	66	377	56	328	2, 198, 051
1928	2, 855, 990	672, 199							112, 474	46, 552	71	1, 753	304	2, 544	2, 968, 839
1929	5, 973, 817	1, 703, 711							469, 189	219, 030	19	289	3, 071	156, 911	6, 446, 096
1930:															
Jan. 1–June 17	3, 607, 744	1, 498, 645							257, 625	169, 581	--------	--------	3, 598	219, 026	3, 868, 967
Duty effective June 18	50 cents per pound on contained W		60 cents per pound and 50 per centum ad valorem on contained W		60 cents per pound and 50 per centum ad valorem on contained W		60 cents per pound and 40 per centum ad valorem on contained W								
June 18–Dec. 31	87, 150	$36, 124	41, 706	$26, 247	108	$275	203	$2, 197	--------	--------	--------	--------	16	580	129, 183

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[1] Prior to Sept. 22, 1922, imports were recorded as ore, alloys, etc.; beginning with change in tariff in 1922 they are recorded as tungsten content of ore, alloys, etc.

[2] Figures not available.

[3] Not separately recorded prior to tariff of June 18, 1930

CHANGES IN DUTIES ON TUNGSTEN

The revised tariff which went into effect June 18, 1930, carried the following provisions affecting tungsten:

> PAR. 301. * * * scrap steel, hammer scale, roll scale, and mill scale, 75 cents per ton: * * * *Provided further*, That nothing shall be deemed scrap iron or scrap steel except secondhand or waste or refuse iron or steel fit only to be remanufactured: *Provided further*, That an additional duty of $1 per pound on the vanadium content in excess of one-tenth of 1 per centum, 72 cents per pound on the tungsten content in excess of two-tenths of 1 per centum, 65 cents per pound on the molybdenum content in excess of two-tenths of 1 per centum, and 3 cents per pound on the chromium content in excess of two-tenths of 1 per centum, shall be levied, collected, and paid on all the foregoing.
>
> PAR. 302. (*e*) Tungsten ore or concentrates, 50 cents per pound on the metallic tungsten contained therein. * * *
>
> (*g*) Tungsten metal, tungsten carbide, and mixtures or combinations containing tungsten metal or tungsten carbide, all the foregoing, in lumps, grains, or powder, 60 cents per pound on the tungsten contained therein and 50 per centum ad valorem; tungstic acid, and all other compounds of tungsten, not specially provided for, 60 cents per pound on the tungsten contained therein and 40 per centum ad valorem.
>
> (*h*) Ferrotungsten, ferrochromium tungsten, chromium tungsten, chromium cobalt tungsten, tungsten nickel, and all other alloys of tungsten not specially provided for, 60 cents per pound on the tungsten contained therein and 25 per centum ad valorem.
>
> PAR. 316. (*b*) Ingots, shot, bars, sheets, wire, or other forms, not specially provided for, or scrap, containing more than 50 per centum of tungsten, tungsten carbide, molybdenum, or molybdenum carbide, or combinations thereof: Ingots, shot, bars, or scrap, 50 per centum ad valorem; sheets, wire, or other forms, 60 per centum ad valorem.

The former duty of 45 cents per pound of contained tungsten in ores or concentrates amounted to $7.14 per short-ton unit,[3] and the new duty is equivalent to $7.93 per short-ton unit.

MARKETS

The world price of wolframite as reflected in London quotations given in the Mining Journal (London) ranged downward from 33 to 35 shillings per long-ton unit ($7.16 to $7.60 per short-ton unit) at the beginning of 1930 to 14 to 15 shillings ($3.04 to $3.26 per short-ton unit) at its close. The comparatively high prices during the first of the year were apparently due to misunderstanding of the market. There had been a short stoppage of shipments from China in 1929 and, because little information was available from that country and dealers showed undoubted willingness to take pecuniary advantage of the lack of knowledge, prices reached unwarranted heights, then fell steadily. When it was seen that new tungsten duties in the United States would soon be put in force they fell more rapidly so that between the middle of May and June 30 they fell from 23 shillings to 15 shillings per long-ton unit ($5 to $3.26 per short-ton unit). At the end of the year, although as already stated wolframite was quoted at 14 to 15 shillings ($3.40 to $3.65) per long-ton unit in the London market, it could be bought c. i. f. New York at about $2.80 (11s. 6d.) per long-ton unit ($2.50 per short-ton unit).

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[3] A unit as applied to tungsten ores is 1 per cent of a ton of tungsten trioxide (WO_3). Thus a short-ton unit is 20 pounds of WO_3, a long-ton unit is 22.4 pounds of WO_3, and a metric-ton unit is 22.046 pounds of WO_3.

High-grade scheelite was nominally quoted at 40 shillings ($9.72) per long-ton unit at the beginning and 17 shillings ($4.13) at the close of the year.

In the United States the price of tungsten concentrates was very close to the cost of foreign ore plus the duty, with scheelite nominally commanding a premium of 25 cents to $1 (depending on purity) per short-ton unit over wolframite. The early January quotations were: Wolframite, $15.50; domestic scheelite, $16.50; and Bolivian scheelite, $15.50. Prices declined until near the end of October when they were quoted as nominally: Wolframite, $12.50; domestic scheelite, $13; and imported scheelite, $12.50. Quotations remained at this point with a 50-cent reduction on imported scheelite to the end of the year.

There was probably no time at which tungsten ores could not be bought somewhat below the quoted price, and toward the end of the year small lots of domestic scheelite were sold as low as $9 per short-ton unit or possibly less.

Owing to the impracticability of making Chinese tungsten concentrates conform to particular specifications a standard contract was devised in Europe allowing fixed deductions for deviations of the delivered ore from the quality demanded, which penalized the seller but did not allow the buyer to reject the shipments.

The contract, a copy of which was furnished by J. J. Haesler, Woolworth Building, New York City, is as follows:

Messrs.

We have this day $\frac{\text{to}}{\text{of}}$ you

the following CHINESE WOLFRAM ORE of good merchantable quality, containing minimum 65 per cent WO_3, maximum 1.5 per cent Sn, maximum 0.2 per cent As, tons (5 per cent more or less)
on the undermentioned terms and conditions:
Price ---------- per unit of WO_3 and ton of 2,240 pounds (1,016 kilos) net dry weight.

c. i. f --
at buyer's option. Packages to be the property of buyers.

Shipment.—From -------------------- during ----------------------------------

Weighing and sampling.—Including the establishment of MOISTURE: To take place at port of destination, or, if in England, at buyers' works, by or under the supervision of a firm mutually agreed upon, each side paying half cost of same. Not more than 25 tons of ore are to be sampled, assayed and settled in one lot, and each lot under a separate shipping mark shall be sampled and settled separately.

Assay.—To be made by one of the following—to be agreed between the buyer and sellers:
Mr. Alfred H. Knight, Liverpool,
Messrs. Benedict Kitto & Sons, London,
The Staatshuettenlaboratorium, Hamburg, or
University Laboratory, Grenoble, and to be final between buyers and sellers, each side paying half cost.

Payment.—80 per cent of provisional invoice on basis of 65 per cent WO_3 net cash against documents on arrival of steamer—balance on rendering of final invoice.

If documents are not presented by sellers by the date of arrival of steamer, all extra expenses incurred thereby are to be borne by sellers.

Impurity penalties.—For each lot sampled and assayed as above.

Quality.—In case of deviation regarding quality and/or contents buyers have no right to reject the goods, provided the WO_3 contents are not under 55 per cent and/or the As contents are not over 2 per cent, but they have to take delivery with the following allowances to be granted by sellers.

WO_3 contents.—In case the WO_3 contents should be under 65 per cent the following allowances are to be made:

For each per cent WO_3 under 65 per cent down to and including 60 per cent	3d.	per unit WO_3 per ton of 1,016 kilos nett dry weight—fractions in proportion.
For each further per cent WO_3 under 60 per cent down to and including 55 per cent	6d.	

If the WO_3 contents should be less than 55 per cent, buyers have the option of rejecting the goods or of accepting same at an allowance mutually agreed upon or (failing agreement) fixed by arbitration as below mentioned, such option to be declared by buyers within 8 days after receipt of the assay certificate.

Sn contents.—If the Sn contents exceed 1.5 per cent but do not exceed 1.6 per cent, buyers have to accept the goods as good delivery. Should the Sn contents exceed 1.6 per cent sellers have to allow to buyers for each one-tenth per cent over 1.5 per cent 2d. per unit WO_3 per ton of 1,016 kilos nett dry weight—fractions in proportion.

As contents.—Sellers have to grant to buyers the following allowances:

If the full As contents exceed 0.2 per cent up to and including 0.25 per cent	3d.	per unit of WO_3 and per ton of 1,016 kilos nett dry weight.
If the full As contents exceed 0.25 per cent up to and including 0.30 per cent	6d.	
If the full As contents exceed 0.30 per cent up to and including 0.70 per cent	9d.	

For each further ½ per cent or part thereof over 0.70 per cent an additional 3d. per unit WO_3 per ton of 1,016 kilos nett dry weight.

If the assay exceeds 0.2 per cent As a second assay is to be made by another laboratory mutually agreed upon by the two parties, the mean of the two results being final. The cost of the second assays is also to be equally divided between buyers and sellers.

If the As contents exceed 2 per cent buyers have the option of rejecting the goods or of accepting same at an allowance mutually agreed upon or (failing agreement) fixed by arbitration as below mentioned, such option to be declared by buyers within 8 days after receipt of the assay certificate.

Buyers have the right to deduct the before-mentioned allowances from the payment of the final invoice.

Advice of shipment.—For all contracts for forward shipment sellers are obliged to obtain at their expense cable advice from the port of shipment giving quantity shipped and steamer's name when shipment is effected.

On ores to arrive.—Vessel lost, contract void for such portion as is lost.

Arbitration.—Any difference or dispute under this contract (or as to the allowances to be given by the sellers to the buyers in the case of deviation regarding quality and/or contents beyond the scales) to be settled by arbitration in the country to which the ore is delivered, in England according to the rules and regulations of the London Metal Exchange in London, in France by friendly arbitration in Paris, and in Germany by friendly arbitration in Hamburg.

Force majeure.—The sellers and buyers shall not be liable for failure to perform this contract due in whole or in part to strikes, lockouts, accidents or any other causes of any kind whatsoever beyond the control of the buyers or sellers, as the case may be, preventing or hindering sellers from shipping or delivering, or buyers from receiving, smelting or delivering to the intended smelter, but in such cases written notice shall be given to the other party of such conditions, and the party in default shall have the right for four weeks from the stipulated dates of shipment or reception or delivery, as the case may be, of effecting or requiring shipment or delivery, but on the expiration of such extended time the party not in default has the right to grant a further extension for four weeks or to cancel the contract without penalty to either party, and if on the expiration of such further extended period, if granted, the sellers or buyers, as the case may be, are still unable to ship, deliver or receive, smelt or deliver to the intended smelter, the contract shall be null and void, provided that the buyers or sellers, as the case may be, in default, shall furnish a certificate of force majeure signed by the consul of the nationality of the party not in default and such certificate shall be conclusive evidence for all purposes. Provided that in case of the buyers' inability to receive, smelt or deliver to the intended smelter, written notice shall be given by the buyers to and received by the sellers before the actual shipment, and in case of the sellers' inability to deliver, such notice shall be given by the sellers to and received by the buyers prior to the date fixed for shipment of the ore.

METALLURGY

Steel making.—A considerable quantity of tungsten steel is now made much as it was made at first by Mushet[4] in the 1850's. In his patent specifications he described the introduction of tungsten as wolframite into the steel. This was later abandoned on account of the impurities, such as sulphur, arsenic, tin, copper, and bismuth, commonly associated with Cornish wolframite. The manganese from the wolframite must be slagged off, so that most tungsten steel has since been made by introducing the tungsten as ferrotungsten or tungsten powder, but the use of tungsten powder in steel making has almost ceased in the United States.

In this country part of the ferberite mined in Boulder County, Colo., has always been introduced directly into the steel, and during the past few years the addition of scheelite directly to the steel has increased considerably; it is to this use that the premium which scheelite has commanded is due. The calcium of the scheelite is removed much more readily in the slag than is the manganese of wolframite or huebnerite.

So far as is known the manufacture of artificial calcium tungstate for addition to steel, in the same manner that calcium molybdate is commonly added, has been negligible.

Tungsten carbide.—The manufacture of tungsten carbide into exceedingly hard tools for cutting difficult materials progressed considerably during the year.

Under patents for making tools by fusing a mixture of very fine-grained tungsten carbide and cobalt held by Fried. Krupp Aktiengesellschaft, Essen, Germany, that firm makes such a compound, which it calls "widia." In this country licensees manufacture it under the names "carboloy" (made by the General Electric Co.), "firthite" (Firth-Sterling Steel Co.), and "Strauss metal" (Ludlum Steel Co.). Hastellite, made by the Haynes Stellite Co., is understood to be a cast tungsten carbide; vascoloy, a compound put out by the Vanadium Alloys Steel Co., is presumably manufactured under a patent issued to Philip M. McKenna covering the use of tungsten carbide cemented by beryllium.[5]

The price of the compound made under the Krupp patent is said to be controlled by the owner of the patent and to be fixed at $1 per gram (15.4 grains).

Each firm carries on its own research work on making the compound, although it has the benefit of the parent firm's experience.

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[4] Mushet, Robert, An Improvement or Improvements in the Manufacture of Cast Steel: British Patent 101, Jan. 12, 1859.

[5] McKenna, P. M., Hard Alloy and Process of Manufacturing the Same: U. S. Patent 1737255, Nov. 26, 1929.

The manufacture of tungsten carbide is such a delicate operation and the output is so small that the process does not lend itself readily to mass production. The manufacture of the alloy is described by Gregory Comstock,[6] as follows:

HISTORY OF APPLICATION SIMILAR TO THAT OF HIGH-SPEED STEEL

Two years of general and increasing application of cemented tungsten carbide to industry have conclusively demonstrated, but have not as yet entirely defined and evaluated, the commercial value of this product. Thus far, the history of its application has been similar to that of high-speed steel, which was one of high anticipation, alternating discouragement and encouragement, and finally of successful and wide-spread utilization. High-speed steel at its inception, however, had one decided advantage over this new material in that it was a product of a well-recognized method of manufacture. The unavoidable mystery and misunderstanding which has shrouded the manufacture and composition of cemented tungsten carbide has undoubtedly militated against its successful use in a great many cases.

In its simplest form cemented tungsten carbide consists of minute irregular particles of tungsten carbide, which are believed to be harder and more stable than the carbides present in high-speed steel, cemented in a thin metal matrix. The tungsten-carbide particles constitute roughly from 85 to 97 per cent of the metal aggregate. The carbides present in high-speed steel can not exceed a third of the amount present in the carbide alloy according to the same rough generalization. Regarded in this light it will be seen that the carbide alloy may be considered as the cutting essence of high-speed steel. It is perhaps reasonable to wonder why its fabrication was not attempted several years ago.

POWDER METALLURGY TO HAVE IMPORTANT PLACE

The original conception of a hard metal alloy composed largely of tungsten carbide was evolved in the electric lamp industry, where the necessity existed for wire dies capable of withstanding the hard usage imposed by the manufacture of metallic-tungsten filaments. The highly refractory nature of tungsten, which precludes its satisfactory casting and working according to the methods commonly applied to metals of lower melting characteristics, familiarized the pioneers of the lamp industry with a type of metallurgy which was peculiarly their own. The processes of this industry are largely founded upon the physical laws which govern the fusion of finely pulverized metals, and the metallurgy involved may quite fittingly be called "the metallurgy of powders." When extremely hard dies were required for the manufacture of filaments, therefore, the powder metallurgist was able to make quite satisfactory ones by the methods with which he was most familiar, i. e., the fusion at high temperatures of tungsten, carbon, and cobalt or iron.

From this beginning has been evolved cemented tungsten carbide, which is to-day practically the only product of a metallurgy that has until recently been confined to the manufacture of one particular product only, but now gives every indication of taking an important place in our manufacturing scheme. Emphasis should possibly be placed on the fact that powder metallurgy is at present in reality the metallurgy of powdered tungsten, or, more recently, the metallurgy of powdered tungsten carbide. Its laws and processes are distinctly in the formative stage. Scientific interest and activity have been quickened, however, by the commercial possibilities presented by the alloys made possible by these new processes, and intensive investigations and study have now been going on for some time. It is safe to prophesy that the present alloy we are discussing is but the forerunner of many other valuable products.

HOW CEMENTED TUNGSTEN CARBIDE IS MADE

The process for manufacture of cemented tungsten carbide alloys includes the preparation of extremely fine tungsten powders of high purity; the carburization of tungsten powders to produce tungsten carbide; the mechanical comminution of tungsten carbide with powdered cobalt; the compacting or pressing of these mixed powders to billet form; the first or presintering heat treatment; shaping; and final sintering. Either tungstic acid (WO_3) or ammonium paratungstate [$(NH_4)_{10}W_{12}O_{41}.11H_2O$] is prepared from carefully selected ores by the chemical processes commonly employed in the preparation of these compounds. When scheelite is the ore used, the preliminary treatment consists of decomposition with a commercial acid. During this treatment the calcium goes into solution and crude tungstic acid remains as a sludge. The reaction may be represented by the equation: $CaWO_4+2HCl=WO_3+CaCl_2+H_2O$. The finely ground ore has been previously mixed with a small quantity of manganese dioxide which completely oxidizes any iron present during this reaction. The crude tungstic acid thus produced is first purified by reprecipitation, being dissolved by the addition of ammonium hydroxide and after filtering reprecipitated by the addition of hydrochloric acid. The purified salts of tungsten are next reduced to the metal in tube furnaces, which contain an atmosphere of hydrogen at a temperature carefully regulated to produce a minimum grain size. The result of this reduction is a fine metallic powder the grain size of which may vary between two and six μ and the purity of which is rigidly kept above 99.5 per cent.

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[6] Comstock, Gregory, Tungsten Carbide—The First Product of a New Metallurgy: Iron Age, vol. 126, Nov. 13, 1930, pp. 1381–1383.

The metallic tungsten is then carburized by any one of several well-known methods, which consist either of passing the powder through a furnace containing a carbonaceous gas or by heating it under hydrogen when intimately mixed with pure and finely divided carbon. The result of the carburizing process is a finely divided powder consisting of tungsten carbide (WC), the hardness of each particle of which has been determined as being between that of the sapphire and the diamond.

This powder is then milled in a stainless steel ball mill with powdered cobalt, which being soft, coats each particle of tungsten carbide more or less thoroughly with a thin pellicle of that metal. The milled metals are then ready for compacting. This operation is performed in a steel die under hydraulic pressure. The powders are pressed into billets of suitable size and shape for the manufacture of tips for tools, dies for drawing wire, etc., etc. These billets are next heated in hydrogen to a temperature which gives them sufficient cohesion to prevent breakage during shaping to the desired conformation. This heating operation is designated as the first or presintering treatment. In the presintered state the material resembles graphite both in appearance and workability and may be shaped with a file or even turned in a lathe without fear of spalling or breaking. The increase in strength which results from this heating to several hundred degrees below the melting point of cobalt is attributable to the fact that the impinging cobalt oxide films are reduced during the treatment and thus lightly cement the powdered metals together. When shaped the pieces are final-sintered at a high, white heat, again in an atmosphere of hydrogen. During this treatment cementation takes place, a marked change in size is noted, and the piece which has previously consisted of a highly porous mass of fine granular particles shrinks to a dense material which is without voids that can be detected at a magnification of 100 diameters. Except for final grinding and perhaps lapping, where a fine finish and sharp edges are desired, the product is now ready for use.

PROPERTIES OF CEMENTED TUNGSTEN CARBIDE

There is at present no satisfactory method of accurately determining the hardness of cemented tungsten carbide. As has been pointed out, its abrasive hardness is the hardness of tungsten carbide, which has been calculated by German investigators to be 9.8 on Moh's scale. The use of the Rockwell tester for determining the hardness of cemented tungsten carbide has been suggested and has met with some general application. The resistance to indentation of the cemented carbide does not give the true hardness of the material but is rather misleading, as it measures in part the strength of the bond, together with a hardness of the cement and the carbide itself. In lieu of better methods of testing, however, the Rockwell hardness tester can be used.

The heat conductivity of cemented tungsten carbide is approximately 0.21 in centimeter-gram-second. The coefficient of expansion is 4.4×10^{-6}. The electrical conductivity is roughly 5 ohms per millimeter squared. The magnetic permeability has been determined as being 2. Cemented tungsten carbide may be expected to decompose at approximately 1,600° C. When subjected to cross-breaking stresses test pieces give a resistance of from 180,000 to 350,000 pounds per square inch, depending upon the grade of the material which is being tested. The compressive strength of the material has been determined as being more than 500,000 pounds per square inch.

FUTURE LIES IN DEVELOPMENT OF GRADES TO SUIT DIVERSIFIED REQUIREMENTS

Several grades of cemented tungsten carbide are available for commercial use. These vary materially in hardness, as measured by indentation tests, and in toughness, as shown by transverse breaking tests. These variations in physical properties were at first produced only by changes in composition but are more recently being brought about by varying the size of the carbide particle. Application of a variety of carbide alloys, to the commercial problems presented, represents the next step in the development of this new type of metal aggregate.

Increasing the amount of bonding cement results in a toughening of this material but necessarily decreases the number of hard carbide particles present in a unit area of cutting edge or abrasion resisting surface. It may therefore be regarded as being one of the poorest ways of strengthening the product. More encouraging results have been obtained, however, by producing material, the carbide particles of which have been sized according to definite proportions. This method was suggested by the similar problem presented to those interested in producing stronger concrete and the development of a modulated stone size to obtain increased material strength. At least one grade of commercial cemented carbide is at present being manufactured according to this method. Investigations are in progress as to the possibility of further increasing the resistance of the material to transverse rupture by particle size regulation.

The introduction of small amounts of metals other than cobalt and the production of alloy binders presents a further possibility of the development of special grades of this material. Many such alloys have been studied and discarded as being undesirable, chiefly, it is believed, because the fundamental laws governing the tertiary alloys of tungsten, cobalt, and carbon have yet to be fully investigated. W. P. Sykes's excellent work on the alloys of tungsten and carbon undoubtedly aid this phase of carbide development most materially.

One interesting and as yet unexplained fact noticed in the development of this material is that the tungsten which is produced from certain ores communicates most unusual and desirable properties of toughness combined with hardness to the finished product. The most carefully conducted analyses of the various tungsten powders fail to reveal differences in composition which are sufficient to explain the results obtained.

Later investigations will doubtless throw light on this subject. At present, however, at least one grade of commercial cemented tungsten carbide is being produced from selected ore, and, although its composition is a usual one, its physical characterstics and performance results are sufficiently unusual to warrant its classification as a distinct grade of carbide alloy.

Stoodite is a tungsten-iron-carbon alloy, and one variety of stellite is a tungsten-chromium-cobalt alloy. Both are used for welding on oil-well bits to give better cutting edges and for similar uses. Duridium, another hard alloy cast in close-grained small, half-round sticks, is said to be tungsten carbide. A number of other hard alloys for oil-well bits are also on the market, and the total quantity of tungsten powder annually consumed in their manufacture is apparently 300,000 to 350,000 pounds.

THE YEAR 1930 IN OTHER COUNTRIES

At the time this report was written at least preliminary statistics for 1930 on the output of tungsten concentrates from the principal producers were available, but figures for a dozen of the smaller producers had not come to hand. The data obtained show a total of 14,895 metric tons of concentrates carrying 60 per cent WO_3. If all the countries not heard from were to make an output equal to that for 1928 the total would be enlarged to a little more than 15,000 metric tons and would be, apparently, less than 500 tons short of the 15,732 metric tons indicated by the figures for 1929.

World production of tungsten ore, 1926–1930, in metric tons of concentrates containing 60 per cent WO_3

Country [1]	1926	1927	1928	1929	1930
North America:					
Mexico				11	28
United States	1,254	1,056	1,096	753	637
	1,254	1,056	1,096	764	665
South America:					
Argentina	11	10	24	63	98
Bolivia [2]	109	79	29	1,630	889
	120	89	53	1,693	987
Europe:					
Czechoslovakia	86	78	73	75	77
France	26	8			
Great Britain (Cornwall)	20	12	96	27	153
Portugal	358	174	151	358	(3)
Russia [4]	22	10		(3)	(3)
Spain	123	164	158	213	196
	635	446	478	673	(3)
Asia:					
China [2]	7,989	5,666	8,283	9,978	[5] 7,749
Chosen	(3)	5	161	15	13
India (Burma)	1,634	1,277	843	1,460	[6] 3,597
Indo-China (Tonkin)	92	213	211	195	228
Japan	19	49	54	61	(3)
Malay States—					
Federated Malay States	99	22	5	351	934
Unfederated Malay States	234	170	139	156	(3)
Netherland East Indies	9	22	8	10	15
Russia [4]	22	32	58	(3)	(3)
Siam	10	8		[2] 62	[2] 7
	10,108	7,464	9,762	12,288	(3)
Africa: Southern Rhodesia		33	15	28	33
Oceania:					
Australia—					
Central Australia [7]				20	67
New South Wales				25	17
Queensland	1	3	29	22	24
Tasmania	98	176	209	180	133
New Zealand [2]	15	15	6	39	(3)
	114	194	244	286	(3)
	12,231	9,282	11,648	15,732	(3)

[1] In addition to the countries listed Ethiopia reports an experimental production of 100 tons of tungsten ore in 1928; content of WO_3 not stated. No further development of deposit reported.

[2] Exports.

[3] Data not available.

[4] Year ended Sept. 30.

[5] Since going to press, figures published by the Maritime Customs of China have become available, which give the exports of 60 per cent concentrates in 1930 as 9,454 tons.

[6] Exports. No details are available as to quality of concentrates, but it is assumed that the figures represent magnetically separated concentrates. If this is not correct, the figures should be considerably smaller.

[7] Part of Northern Territory prior to division in 1927 into Central Australia and North Australia.

China.—During most of the troublous times through which China has been passing ever since tungsten was discovered in quantity in Kiang Si in 1915, war—contrary to common reports—has interfered little with production, because the party in power always found the concentrates a good subject for taxation and thus a source from which to raise revenue, so that, instead of being stopped, production was encouraged so long as the taxes were paid.

Ore was bought from the local producers by several buyers. Trouble was started when, in 1929, a rival, unable to obtain ore which he had agreed to deliver, aroused the cupidity of provincial officials and induced them, under the pretext that the ore had been mined from land belonging to the Province and therefore belonged to the provincial government, to seize a large quantity of ore which the principal buying company had purchased from the miners. As the company was then unable to deliver ore it had contracted to supply, rumors were started, and believed by hearers, that mining had practically stopped and that the situation was so uncertain that companies refused to continue the purchase of concentrates which might immediately be confiscated. As a matter of fact it seems probable that mining at no time stopped, but that owing to taxes and perhaps to bandits concentrates were not shipped over the usual route to the Yangtze Kiang and Shanghai; this difference in routing increased the belief that mining had stopped and that there would be a shortage. Prices began to rise and reached about $6 per unit in Hong Kong.

Smuggling of ores started down the Yung Ying Gong, a branch of the Pe Kiang or North River, to Canton; probably a certain quantity of concentrates also reached Swatow, and the provincial government fed out at the high prices the ores it had confiscated. Eventually the provincial government was overruled by the national government; but the ores had been sold, and the victimized company, which had conducted negotiations on a high plane of integrity, lost its money. The high prices induced a higher production than usual, which seems to have been sold at the advanced prices before buyers realized that the apparent shortage was unreal. The Kiang Si government attempted to farm out at a high figure the concession for mining tungsten, but the uncertain treatment which might be accorded by the provincial government to a concessionaire has not encouraged persons or companies with capital to enter such an agreement. With the growing power of the central government and the increasing influence of highly educated young men of high ideals such conditions will change. During 1930 export licenses were sold to all who applied. Under the falling prices of silver and the world-wide depression, prices for tungsten concentrates fell to a low point; nevertheless, shipments were high.

Normally, the tungsten produced in Kiang Si has, as already intimated, moved down the Kan Kiang in sampans to Nan Chang, thence to Kiu Kiang on the Yangtze Kiang, where it was stored or transshipped to Shanghai.

During 1930 the flow of concentrates was southward over the low mountains into Kwang Tung. Much, if not all, of the material came down the Yung Ying, which has some beautiful but very difficult rapids—so difficult, indeed, that this is one of the comparatively few places in this part of China where women are not found working on sampans with the men.

Little is publicly known about the producing fields of China. The reason is that they are a number of days' journey from cities in which foreigners live. To reach them an American or a European must take his own cook, food, and camping outfit and for much of the way must either walk or ride in a chair. Even if he takes a chair he must get out and walk over all difficult places and climb all hills. Soldiers must also be taken as protection against bandits. Every drop of drinking water must be boiled, for, although the Chinese have become resistant to many water-borne diseases, white men acquire typhoid fever or other intestinal troubles, which are frequently acute within two or three hours after taking a drink of seemingly pure water. Coolies will drink without apparent bad effect water which seems to be too filthy for possible human consumption.

Some concentrates are said to be produced in southeastern Hunan, and a quantity is shipped out by way of Changsha, Hankow, and the Yangtze Kiang. Some are said to be produced in northeastern Kwang Tung, and a little wolframite is produced in Kwang Si east and northeast of Pinglo. During 1930, according to United States consular reports,[7] 5,585 short tons of concentrates were shipped from Hong Kong, 1,015 tons from Canton, 1,072 tons from Shanghai, and 213 tons from Hankow—a total of 7,885 tons. These concentrates probably carried 65 per cent or more WO_3. At 65 per cent WO_3 the shipments would be equal to 8,542 short tons (7,749 metric tons) carrying 60 per cent WO_3.

British Malaya.—Few details are yet available concerning the production of tungsten ore in the Malay Peninsula. It is known that the scheelite mine at Kramat Pulai 10 miles east of Ipoh, Perak, considerably increased its output.

The occurrence at Kramat Pulai is a remarkable pipelike deposit in schist which Dr. J. B. Scrivenor, Government geologist, considers to be made probably from an impure limestone. The schist is so decayed that it can be cut down by water under a pressure of a little more than 100 pounds per square inch.

Close to the contact of the schist with granite is a whitish lenticular mass of rock, 60 feet across and 120 feet long, which has resisted weathering. It is a brecciated mass of limestone which at one corner was intruded by aplite, brecciated like the limestone, and now decayed. The breccia is cemented by generally colorless fluorite which incloses white scheelite.

No quartz was seen in climbing over the deposit. The ore is very free from visible impurities, but when certain lots are milled some chalcopyrite and cassiterite appear.

During 1930 the mine was actively worked. Remarkably clean high-grade scheelite from the Malay Peninsula has appeared on the New York market, apparently all from Kramat Pulai. A composite analysis, made by averaging the results from five lots of scheelite, follows:

Composite analysis of scheelite from Federated Malay States

Constituent	Per cent
Tungsten trioxide (WO_3)	73.61 to 74.35
Tin (Sn)	Trace to .05
Metals precipitated by H_2S [8]	Traces to .01
Phosphorus (P)	None to .01
Arsenic (As)	None to .01
Sulphur (S)	None to .02

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[7] Use has been made of the following reports:
Milburn, H. L., Hankow. Review of tungsten market for the quarters ended Mar. 31 and June 30, 1930.
Pilcher, J. B., Hankow. For the quarters ended Sept. 30 and Dec. 31, 1930.
Jacobs, J. E., Shanghai. The Shanghai tungsten market for the quarters ended Mar. 31 and June 30, 1930.
Spamer, C. C., Shanghai. The Shanghai tungsten market for the quarter ended Sept. 30, 1930.
Huston, J. C., Shanghai. The Shanghai tungsten market for the quarter ended Dec. 31, 1930.
Shantz, Harold, Hong Kong. Tungsten ore market in Hong Kong. Reports for the first, second, and fourth quarters, 1930.

[8] A very little iron is present.

The total impurities are not more than 0.1 per cent. This tungsten ore is probably the cleanest ever marketed in quantity.

Exports during 1930, according to the quarterly reports of the Federated Malay States Government Gazette, amounted to 908.5 long tons of scheelite, valued at 631,180 Straits dollars, and 80.9 tons of wolframite, valued at 33,191 Straits dollars. The concentrates are thought to average at least 70 per cent WO_3 and may average more. On a basis of 70 per cent WO_3 the exports would be equivalent to 1,293 short tons of concentrates carrying 60 per cent WO_3. On the same basis the exports in 1929 were 366 short tons of scheelite and 58 tons of wolframite. In 1928 less than 7 short tons of wolframite were exported, but no scheelite was exported. During that year the pit in which the Kramat Pulai scheelite occurs was filled with water and used as a swimming pool.

Bolivia.—Bolivia, like other countries, responded quickly to the rise in price of tungsten ore in the second half of 1929. Easley & Inslee's Conde Auque mine, 45 kilometers (28 miles) by poor automobile road northeast of Oruro, from which ore had been produced only spasmodically for 10 years previously, was put into active operation and proved to be one of the richest tungsten veins so far discovered. Ore was said to reach 50 per cent or more WO_3 as taken from the mine. Practically all the gangue in the upper part was barite. As depth has been attained, the gangue has varied in the relative quantities of quartz and barite. The tailings from the mine, in part at least, are richer than the ore from most tungsten mines, but the quantity of barite present makes recovery very difficult. Flotation methods for tungsten minerals have not yet proved practicable, and although barite has been floated the process has not been applied to this particular mixture.

A part analysis of one lot of 550 bags, weighing 55,812 pounds, and of a second lot of 550 bags, weighing 55,512 pounds, sampled and analyzed by Ledoux & Co., gave the following result:[9]

Part analyses of two lots of scheelite concentrates from the Conde Auque mine, near Oruro, Bolivia

Constituent	I	II	Constituent	I	II
	Per cent	*Per cent*		*Per cent*	*Per cent*
Tungsten trioxide (WO_3)	63.08	59.85	Antimony (Sb)	0.07	0.09
Tin (Sn)	Trace	Trace	Arsenic (As)	.03	.01
Copper (Cu)	Trace	Trace	Sulphur (S)	2.53	3.20
Phosphorus (P)	.07	.09			

Ore from the mine was offered for sale in the spring of 1931 under the following guarantee of quality:

Constituent	Per cent	Constituent	Per cent
Tungsten trioxide (WO_3)	55 to 65	Antimony (Sb)	Not more than 0.15
Tin (Sn)	Trace	Arsenic (As)	Not more than .05
Copper (Cu)	Trace	Sulphur (S)	2 to 4
Phosphorus (P)	Not more than 0.16		

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[9] Information furnished by Metal & Ore Corporation, Woolworth Building, New York City.

The old Stewart mine, 2 miles north of the Conde Auque, was operated in a small way only, although it is reported that richer ore has been found in the lowest level.[10]

The Simon Patiño interests mined wolframite at Kami on Cerro Kami, about 80 miles by trail northeast of Oruro. During the dry season, after the washed-out road has been repaired, automobiles can get within a 5-hour trip (for a light man with a good mule) of the mine. For the ordinary mule with a pack or a heavy rider seven hours is a more reasonable time to allow for the journey.

The wolframite is accompanied by some cassiterite (tin oxide), even though the wolframite veins and the tin veins are said to be in separate systems in the mine. The country rock is quartzite. It seems probable that tungsten can not be mined profitably at less than $6 a unit c. i. f. New York and that at that price the mine will normally produce not more than 50 metric tons of 60 per cent WO_3 per month.

Some wolframite was mined by J. Enrique Soria from the network of veins near the top of Cerro Chicote, about five hours farther in the same general direction from Oruro, at an altitude of more than 14,000 feet. The mountain is very steep, and the top is a still steeper, huge, bare mass of quartzite. Little regard has been had for the safety of miners, and according to local report more than 50 workers lost their lives through slipping on the face of the mountain when the veins were being mined by others during the Great War.

Some wolframite (ferberite?) was produced at Leque Palca, about 50 kilometers from Oruro on the same road. The vein is remarkable in that it is almost a replica of some of the Boulder County (Colo.) veins, except that it carries some stibnite. The quartzitic country rock is further silicified and the ore is very hard and difficult to mine. The cost for this mine at best is probably about $6 per long-ton unit c. i. f. New York.

Many other properties in Bolivia produced small quantities of tungsten concentrates in the early part of the year.

India (*Burma*).—Burma produces wolframite, mostly from residual débris (called eluvial deposits by British geologists) in the territory north and east of Tavoy. There are large quantities of this material and many unworked veins. The Hermingyi (pronounced her-min-gee′) mine is the principal property, and is equipped with 50 or 60 miles of ditches to supply water for washing the débris. In 1929, 24 inches of rain fell in 12 days, which is probably not very unusual, for the annual precipitation is said to be about 240 inches. However, for about three months no rain falls, the country is rough, and the water drains away quickly, so that the streams run very low, and for continuous work water must be stored. The company operating the Hermingyi put in several dams, the largest only 35 feet high, but with it formed a reservoir of 6 or 7 square miles surface.

In 1929 exports of tungsten concentrates amounted to 1,608 long tons (1,801 short tons), part probably from stock, and in 1930 exports amounted to 3,268 long tons (3,660 short tons).

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[10] For further description of these two mines see Hess, Frank L., Some Unique Bolivian Tungsten Deposits: Eng. and Min. Jour., vol. 112, September, 1921, pp. 492–499.

Portugal.—Little exact news about Portuguese tungsten production is available. Consul Leslie A. Davis, under date of March 24, 1931, writes as follows:

> It is stated that most of the mines in this consular district have closed down temporarily due to the low prices of minerals quoted in the English and other markets. It is said that the prices offered do not in most cases cover the expense of working the mines. Wolfram and tin ores are the principal minerals produced in this district.
>
> The mine of Borralha & Cia. (in the Minho region), which is the principal wolfram mine in this country, is actively working full time because of a contract that this company has with the French Government for the supply of 30 tons of wolfram ore per month. This shipment is made to Marseille every month. The "Penasqueira" wolfram and tin ore mine is, together with three or four others in the district, also working normally.
>
> Near Amarante there is a French company preparing to exploit a wolfram and tin mine which it is said to have recently purchased. A large number of these mines are offered for sale, and it is said that there is a good opportunity to buy mines of wolfram, tin, and uranium ores at low prices, due to the impossibility of exploiting them now when the minerals are quoted so low.
>
> Tin ore is quoted at present at 120 pounds sterling per metric ton, wolfram at 12 shillings per metric unit (22.046 pounds of WO_3).

Probably in Portugal, as in other mining countries, many mining claims are taken up more on hope than on real evidence of mineral deposits, but the American consul at Oporto[11] gives the following record of claims in 1928:

> *Wolfram mines.*—There were 370 concessions of 18,884 hectares[12] for mining wolfram. Of these 74 of 3,392 hectares were in Aveiro, 15 of 732 in Braga, 9 of 446 in Bragança, 76 of 3,671 in Castelo Branco, 67 of 3,332 in Guarda, 3 of 150 in Viana do Castelo, 65 of 3,339 in Vila Real, and 81 of 3,828 in Vizeu.
>
> *Uranium and wolfram mines.*—There were 4 concessions of 216 hectares for mining uranium and wolfram. Of these 1 of 50 was in Guarda, and 3 of 166 in Vizeu.
>
> *Tin and wolfram mines.*—There were 20 concessions, of 1,527 hectares, in the whole country for mining tin and wolfram. Of these 1 of 50 was in Aveiro, 4 of 159 in Bragança, 1 of 50 in Castelo Branco, 13 of 662 in Guarda, 1 of 50 in Viana do Castelo, 3 of 393 in Vila Real, and 1 of 163 in Vizeu.
>
> *Antimony and wolfram.*—There was only one concession for mining antimony and wolfram. This was of 50 hectares in the district of Castelo Branco.

Tasmania.—Tasmania is a small but very consistent producer of tungsten, and the concentrates are very rich.

Representative analyses of Tasmanian wolframite handled by Charles Hardy (Inc.) of New York during 1930 were as follows, in percentages:

WO_3	72.07	73.37	73.62	73.74	73.98
Sn	.15	.19	.20	.17	.20
As	None.		None.		
P	Less than .01		None.		
Mo	Trace (?).				None
S	1.10				
SiO_2	1.66				
Cu	.055				
Mn	5.24				
Al_2O_3	Less than .10				
H_2O	.04				

CONSUMPTION

The domestic consumption of new tungsten is approximately shown through a period of years by sales of domestic concentrates, plus imports, less exports. Figures for the tungsten content of tungsten-bearing materials imported previous to September 22, 1922, when tariff regulations first imposed a duty on the tungsten content of tungsten-bearing materials, were mere estimates. In 1923 and 1924, owing to the large stocks held in this country, there were no imports of concentrates; and in 1925 the stocks held were still considerable, so that figures before 1926 mean little.

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[11] Yerby, W. J., Mining in Northern Portugal: Consular Rept. 295,090, Oporto, Nov. 12, 1928.

[12] A hectare equals 2.471 acres.

The figures available for the period since 1926 are shown in the following table:

Apparent consumption of new tungsten in the United States, 1926–1930, as shown by imports and production less exports

Year	Supply (contained tungsten—pounds of metal)			Exports of ferrotungsten, tungsten metal, and wire (contained tungsten—pounds of metal, estimated)	Apparent consumption of new tungsten	
	In ore and alloys imported	In domestic ore shipped	Total		Pounds of metal	Equivalent as short tons of 60 per cent WO_3 concentrates
1926	2, 883, 867	1, 315, 000	4, 198, 867	23, 504	4, 175, 000	4, 387
1927	2, 198, 051	1, 108, 000	3, 306, 051	16, 114	3, 290, 000	3, 457
1928	2, 968, 839	1, 150, 000	4, 118, 839	13, 313	4, 105, 000	4, 314
1929	6, 446, 096	790, 000	7, 236, 096	82, 257	7, 154, 000	7, 517
1930	3, 998, 150	668, 000	4, 666, 150	23, 983	4, 642, 000	4, 878

It is at once seen that the apparent consumption for 1929 is far out of line with that for other years. This was due to imports made to avoid paying the increase in duty which it was known would be levied. The total apparent consumption for the other four years is 17,036 short tons, and the average apparent annual consumption is 4,259 short tons of concentrates carrying 60 per cent WO_3, or in round numbers 4,300 short tons (3,900 metric tons).

The European consumption of concentrates is largely confined to Great Britain, France, and Germany. Most other European countries, so far as present information shows, buy their tungsten steels or else buy ferrotungsten or tungsten powder for the manufacture of steels.

France does not publish figures that allow an estimate of its consumption of tungsten, but figures of the imports. production, and exports of tungsten concentrates for the United Kingdom during the four years from 1926 to 1929 and of the imports and exports of tungsten concentrates for Germany during the five years from 1926 to 1930 have been as follows:

Apparent consumption of tungsten concentrates in the United Kingdom, 1926–1929, in metric tons

Year	Imports	Production	Exports	Apparent consumption
1926	4, 383	20	2, 301	2, 102
1927	3, 040	12	1, 360	1, 692
1928	2, 602	96	1, 541	1, 157
1929	3, 999	27	2, 204	1, 822
Total	14, 024	155	7, 406	6, 773
Average	3, 506	39	1, 852	1, 693

Apparent consumption of tungsten concentrates in Germany, 1926-1930, in metric tons[1]

Year	Imports	Exports	Apparent consumption
1926	2,563	114	2,449
1927	4,507	53	4,454
1928	4,765	317	4,448
1929	4,089	381	3,708
1930	4,347	183	4,164
Total	20,271	1,048	19,223
Average	4,054	210	3,845

[1] No production reported.

The annual output of steel ingots and cast steel during the five years 1926 to 1930 in the United States has averaged 48,381,000 long tons. As shown, an apparent average of 3,900 metric tons of new tungsten concentrates carrying 60 per cent WO_3 has been consumed, or 1 metric ton of concentrates to 12,400 long tons of steel. During the same period (1926 to 1930) Germany has made an average of 13,978,000 long tons[13] of steel per year and has apparently consumed 3,845 metric tons of 60 per cent WO_3, or 1 metric ton of concentrates to 3,635 long tons of steel.

The United Kingdom has manufactured a yearly average of 8,702,500 long tons of steel ingots and cast steel during the years 1927 to 1930 and has apparently consumed 1,693 metric tons of 60 per cent WO_3, or 1 metric ton of concentrates to 5,140 long tons of steel.

The great difference in apparent consumption of tungsten per ton of steel is probably due to the larger shipments of tungsten steel, ferrotungsten, and tungsten powder from Germany and the United Kingdom and to the much larger proportion of elaborately machined steel produced in these two countries than in the United States.

The steel trade of France is probably very similar to that of Germany, both as to the proportion of tungsten products shipped abroad and the machining required by its steel manufactures.

In the 5-year period 1926 to 1930 France, including the Saar region of Lorraine, made an annual average of 10,852,000 long tons of steel ingots and cast steel, which at the apparent German rate of consumption would indicate a consumption of about 3,000 metric tons of tungsten concentrates carrying 60 per cent WO_3. It is commonly believed that France imports more concentrates than these figures indicate and that a stock has been accumulated.

Japan's steel trade probably resembles that of the United States more than it does that of the European nations. Its steel production during the period 1926 to 1930 has averaged about 1,764,000 long tons a year, and supposing it to use 1 metric ton of 60 per cent WO_3 concentrates per 9,000 or 10,000 long tons of steel, it would use not more than 200 metric tons.

Epitomized and rounded items of the apparent consumption in metric tons of concentrates carrying 60 per cent WO_3 are:

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[13] Iron Age, vol. 127, Jan. 1, 1931, p. 93.

	Metric tons
United States	3,900
Germany	3,850
United Kingdom	1,700
France	3,000
Japan	200
	12,650

The sum of the imports and the production of the United States in 1929 was 6,896 metric tons, which is 2,996 metric tons higher than the average consumption used in this estimate, and if added to the apparent world's consumption gives a total of 15,646 metric tons, which closely approximates the world's production (15,732 metric tons) for the year.

During 1929 the Union of Soviet Socialist Republics (Russia) bought 1,069 metric tons of ferrotungsten,[14] mostly from Germany, and 1,643 metric tons in 1930. At the close of 1930, however, the Molybdenum Corporation of America was furnishing Russia with large quantities of ferrotungsten.

BIBLIOGRAPHY

During the year the following articles and patents on tungsten were among those which appeared or became available:

ABRASIVE INDUSTRY. Grinding tungsten carbide tools. Vol. 11, 1930, p. 43. Describes a new machine with 9-inch cup wheels, 2 inches thick, on each end of a spindle.

——— Grinding tungsten carbide tools. Vol. 11, pp. 54–58. Due to the cost per gram of a carboloy tip, great precaution should be taken to prevent waste in grinding. A tool should not be crowded against a wheel at any time, whether rough or finish grinding is being done. Light pressure will enable an effective cutting action to take place without glazing or loading of the wheel and without undue waste either of the tool or the wheel. Carboloy can be ground dry or wet with equal results. Describes grinding tungsten carbide tools with diamond dust.

ADAMS, R. L. (to General Electric Co.). Hard metallic composition. U. S. Patent 1775014, September 2, 1930. Describes the process of making a metal composition, which comprises introducing a dry mixture of carbon and an oxide of a metal of the sixth group in the Mendelejeff Periodic System of Elements into an aqueous solution of a compound of a metal of the iron group in said system, which compound is easily decomposable by heat to the oxide, heating the mixture in air to decompose the compound, firing the mass so obtained in a reducing atmosphere, and pressing and sintering the fired mass.

AGTE, C. The mechanical and other properties of the hardened metal "Widia." Metallwirtschaft, vol. 9, 1930, pp. 401–402. A general article on tungsten carbide tools.

AMERICAN MACHINIST. Tungsten carbide. Vol. 72, February 20, 1930, p. 349. Tungsten carbide is manufactured under a variety of trade names and in slightly varying compositions. A general analysis is C, 3 to 6 per cent; W, 80 to 95 per cent; and Co, up to 13 per cent. Cobalt is added for physical strength. The Brinell hardness number of tungsten carbide is 2,000 to 2,500. Due to its extreme hardness it will cut materials which tool steel can not touch. Higher cutting speeds are possible than with tool steel.

BAEKE, M. Nickel-Wolframstahl. Austrian Patent 116860, July 15, 1928. Patents a steel containing 0.6 to 1.5 per cent C. 0.5 to 3 per cent Ni, and 1 to 5 per cent W. The tungsten may be partly replaced by vanadium.

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[14] Information from the Soviet Union Information Bureau, Washington, D. C.

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Carlborg, Harald. Världens wolframmalmtillgangar. (The world's tungsten resources.) Jernkontorets Annaler, vol. 114, September, 1930, pp. 455–490. Discussion of occurrence, uses, consumption, prices, geographical distribution, and statistics.

Curtis, F. W. More chips from tungsten carbide tools. Am. Mach., vol. 72, April 10, 1930, pp. 608-611. Tungsten carbide tools should be ground as often as the tool steel previously used. To secure the proper service the speed and the feed should be increased. This often requires larger and heavier tools. Too wide or too long tips are to be avoided. The success of any metal cutting operation depends on rigidity, so it is better to use a heavier tool than actually necessary.

Dewey, E. K. (to General Electric Co.). Electrode for the electric arc. U. S. Patent 1774965, September 2, 1930. Specifies a carbon shell with a core comprising cerium and boron compounds, together with carbon, cerium fluoride, and tungsten carbide.

Digges, T. C. Cutting tests with cemented tungsten carbide lathe tools. U. S. Bureau of Standards Jour. Research, vol. 5, August, 1930, pp. 365–368. Metals and Alloys, vol. 1, November, 1930, pp. 836–839. Gives the results of testing cemented tungsten carbide lathe tools under heavy duty and efforts to extend to the new cutting material some of the laws originally developed by Taylor and his associates for cutting with carbon and high-speed steel tools. Relations were determined between the speed, feed, depth of cut, and tool life for a selected form and size of tool. All tests were made dry in cutting 3.5 per cent nickel steel forgings, heat treated to given tensile strengths within the range of 85,000 to 110,000 pounds per square inch. The results are presented in both graphic and tabular forms.

Doan, J. B. (American Tool Works Co.). Our experience with tungsten carbide tools. Machinery (London), vol. 37, September, 1930, p. 6. Carboloy tools have been used by the company since March, 1929. Used for turning and boring columns, column sleeves for radial drills, column rings, rough turning of lathe faceplates, turning cast-iron sleeves for both radial drills and lathes, machining semisteel gear blanks. Discusses rate and depth of cut used. Savings have resulted from use of carboloy tools, but they can not be used successfully with out-of-date machines.

Drury, C. W. The manufacture and uses of stellite. Canadian Min. and Met. Soc. Bull. 219, 1930, pp. 930–944. Stellite is made by melting cobalt, chromium, and tungsten with some carbon in an electric furnace, either arc or induction. It must be cast in graphite molds to obtain the required crystal structure. All stellite cast for cutting tools is tested for hardness (Rockwell 61C, Brinell 600), breaking under shock and transverse load, microstructure, and cutting properties on a lathe. Stelliting material is also tested for fluidity and abrasion. X-ray study indicates the presence of Cr_4C and Cr_7C_3 in low-tungsten stellite and both single and double carbides of chromium and tungsten in high-tungsten stellite. The extreme hardness seems due to the carbides and to distortion of the solid solution lattice. The physical and chemical properties, grades, and uses are reviewed. The compressive strength is 315,000 pounds per square inch, but the tensile strength is only 55,000 to 98,000. For stelliting, the material is cast in rods, which are then used to deposit a layer of stellite by means of either an oxyacetylene torch or an electric arc. The stellited surface wears three to seven times as long as steel, besides possessing heat and corrosion resistance.

Engineering and Mining Journal. Tungsten carbide improves circular saw. Vol. 130, July 24, 1930, p. 81. Quotes C. M. Thompson as saying that circular saws tipped with tungsten carbide will operate at speeds and feeds far beyond the range of high-speed steel without losing their cutting edges or clearances and will produce from 10 to 50 times the work per sharpening, depending upon the material to be cut. Application of the new material has necessitated changes in saw design. Former theories and practices have had to be largely discarded in order to design teeth able to support the tungsten carbide tip properly and withstand the shocks to which it is bound to be subjected. The first saw tipped with tungsten carbide was demonstrated publicly in Cleveland in the fall of 1929. This application of the alloy marks the fourth stage in the development of circular saws since their introduction about 150 years ago. Up to 1840 only solid saws were available. Then came the carbon steel and high-speed steel inserted-tooth saws, and next the tungsten carbide tipped, inserted-tooth saw. Others have been surpassed by the tungsten carbide tipped tool.

Fisher, D. J. Huebnerite from Kendall, Mont. Am. Min., vol. 15, 1930, pp. 104–108. A goniometrical study of a crystal of huebnerite found in a breccia composed of dacite or rhyolite porphyry, quartzite, and limestone.

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Gronwall, E. A. A. Satt att framstalla legerad volfram. Swedish Patent 69397, May 15, 1928. Process for producing tungsten alloys.

Heany, J. A. (to Sirian Lamp Co.). Article of metallic oxides. Canadian Patent 303669, September 2, 1930. An electric incandescent lamp filament, consisting of a ferrotungsten alloy composed approximately of 95 per cent tungsten and 5 per cent iron, and having an incandescent efficiency of approximately 1 watt per candle and being substantially free from perceptible disintegration at that efficiency.

Hitchen, C. S. The analysis of wolframite and scheelite. Min. Mag. (London), vol. 43, 1930, pp. 208–220. The effect of tungsten on the separation of other elements makes a complete ore analysis difficult, and especially so in presence of tantalum, columbium, tin, and titanium. The occurrence and mineralogy of tungsten are described and analytical methods discussed at length, with recommendations and a diagrammatic scheme for procedure. A bibliography is also given.

Hoyt, S. L. Preparation of microsections of tungsten carbide. Trans. Am. Soc. Steel Treating, vol. 17, January, 1930, pp. 54–58. The specimen, which may be either broken or cut out with a diamond saw, is first ground to a plane surface on a silicon carbide wheel, grades known as 60-I, 80-II, or 100-T having been found satisfactory. The next step is lapping with 140 to 200 mesh boron carbide (silicon carbide is not satisfactory here) moistened with kerosene on a smooth copper disk running at approximately 150 r. p. m. The final polish is given with No. 7 diamond dust (1.5 μ to 2 μ) in almond oil on a wooden lap running at same speed. For fine work a further polish is given with No. 9 dust (about 0.5 μ). Five minutes for the respective lapping operations has been found sufficient for specimens one-quarter inch square. Boiling hydrogen peroxide and a mixture of 3 parts of 30 per cent HF with 1 part of concentrate HNO_3 have been used for etching.

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Jackson, K. S., Russell, A. S., and Merrill, J. L. Electrolytic deposition of tungsten at a mercury cathode. Jour. Chem. Soc. (London), vol. 131, October, 1929, pp. 2394–2398. The statement by Feree that tungsten may be deposited electrolytically at a mercury cathode from a solution of the trioxide or sodium tungstate in hydrofluoric acid is confirmed. The most favorable conditions for the deposition are: A temperature of 95° C.; an acid concentration of 4.6 N, and a range of current densities of 0.65 to 1.0 ampere per square centimeter. A second acid, such as hydrochloric or sulphuric acid, must not be present.

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Langmuir, Irving, and Kingdon, K. H. Contact potential measurements with adsorbed films. Phys. Rev., vol. 34, 1929, pp. 129–135. Measurements have been made of the contact potential differences between a clean unheated tungsten filament and the same filament coated with an adsorbed film of thorium, cæsium, oxygen, or a mixture of cæsium and oxygen. An example is given of the application of the method to the measurement of the changes in work function produced by heating a tungsten filament to various temperatures in the presence of cæsium vapor, thus changing the amount of adsorbed cæsium.

Lord, C. B. More chips from tungsten carbide tools discussion. Am. Machinist, vol. 72, 1930, pp. 985–986. There are many exceptions to the statement that the "ideal application is one in which the tool is ground as often as the steel tool previously used." Increase in machine size is not always economical and does not always produce the desired result. More information concerning cutting by tungsten carbide is needed before some of the claims for it can be substantiated.

Machinery (London). The tungsten situation and its effect upon high-speed steel prices. Vol. 35, 1930, p. 456. The effect of ferrotungsten prices on the tool-steel industry is discussed, also the reasons for the increase in price and the outlook for the future. When it is known through what channels regular supplies can be obtained from China, a clearer view of the situation should be possible.

——— New applications of tungsten carbide tools. Vol. 36, 1930, pp. 892–894. Reviews the papers and reports on tungsten carbide tools given before the Machine Shop Practice Division of the American Society of Mechanical Engineers at the semiannual meeting at Detroit, June 9 to 12, which devoted an entire session to the subject. This is a brief review of that session. Discusses the use of tungsten carbide in lathe tools, for saws, and for heavy machine tools; present applications, materials for which it may be used, machine equipment, tool sizes, grinding of tools, cutting speeds, and results and failures of tools.

——— Machines for tungsten carbide tools. Vol. 37, 1930, p. 48. Summarizes the suggestions made regarding the construction of machines to be used with tungsten carbide tools.

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——— (to Westinghouse Lamp Co.). Thoriated tungsten filament. U. S. Patent 1764644, June 17, 1930. NH_4F is added to an ammoniacal solution of WO_3, and the solution is acidified with an acid solution containing a proportion of an acid solution of a thorium compound substantially equivalent to the NH_4F used. The precipitated tungstic acid and thorium fluoride mixture is recovered, and the tungsten in the mixture is reduced to metal by heating with hydrogen and is used for filaments which have good resistance to offsetting.

Rhodesian Mining Journal. Scheelite in the Victoria district. Vol. 4, 1930, p. 519. The M'Dara property 45 miles east of Fort Victoria is said to have scheelite showing crystal form in "epidote and olivine reefs," which are similar to the Beardmore deposits 3 miles farther east. Some ore is said to carry 10 per cent scheelite. A small mill has been erected. Transportation is easy, as motor trucks run to the property. Similar deposits have been discovered on the Bofana property, and other claims have been located.

St. Clair, L. J. Cemented tungsten carbide as applied to cutting tools. Am. Soc. Mech Eng., preprint No. 50, December, 1930, Meeting. 5 pp. Cemented tungsten carbide, beside extreme hardness, has the highest compressive strength and highest modulus of elasticity of any known material, low electrical conductivity, and a very low thermal coefficient of expansion. In the use of cemented tungsten carbide machine tools the proper clearance angle is very important, and the machine and tool set-up must be rigid. The material is only about one-half as strong in transverse rupture strength as high-speed steel. This fact, plus its high modulus, makes the material refuse to bend without breaking. Failure to comply with the need for rigidity is one of the chief causes for tool failure. Rigidity in the set-up of the grinding machine used for dressing the tools is also important. Light pressure and slow feed with wheel surface speed at about 5,000 feet per minute are preferable for grinding.

Schröter, Karl (to General Electric Co.). Hard alloy for tools and the process for their production. U. S. Patent 1774849, September 2, 1930. An alloy with a fine-grained eutectic structure contains from 58.1 to about 67 atomic per cent of tungsten, molybdenum, or chromium, and about 32 to 41.9 atomic per cent of carbon, boron, titanium, and silicon.

Sellers, Coleman, 3d. The use of tungsten carbide as a cutting material on heavy machine tools. Mech. Eng., vol. 52, 1930, p. 683. A brief review of the experience of an early user of tungsten carbide tools on cast iron, in which the author describes the steps taken to introduce this material into the machine shop and the method used to follow up the results obtained.

Senen, C. Filament métallique pour lampes électriques à incandescence, résistances électriques et usages analogues. Belgian Patent 370823, June 4, 1930. The filament is formed of an alloy of tungsten, thorium, iridium, nickel, and chromium or of an alloy of tungsten, thorium, and zirconium. It has an elongated cross section, either an ellipse or a double parabola.

Siemens & Halske A.-G. Bodenstück für Geschütze. German Patent 500780, June 20, 1926. According to the invention the breechblocks of guns, especially marine guns, are manufactured wholly or partly from a 2 to 10 per cent nickel-containing tungsten alloy. The nickel can be replaced wholly or partly by cobalt, the tungsten by tantalum. It has thus been shown in an astonishing manner that the mechanical properties of these well-known alloys, in spite of their high tungsten content, answer the requirements and that on account of the extraordinarily high specific gravity of these alloys considerable space can be saved. The alloys can be expediently produced by sintering at a temperature of 1,400° to 1,500°.

Spencer, F. C. Tungsten carbide cutting materials. Mech. Eng., vol. 52, 1930, pp. 777–780. The article is Progress Report 2 of the subcommittee on tungsten carbide cutting materials of the A.S.M.E. The report gives a digest of about 50 replies to a questionnaire sent out by the National Machine Tool Builders' Association. The following items are considered: The extent of application, kind of material cut, machine equipment used, tungsten carbide tools used, grinding of tungsten carbide tools, method of tapping, cutting speeds, feeds and depths of cut, economies compared with high-speed steel and stellite, failures, suggestion for design changes of machinery, and attitude of labor with respect to the material.

Thompson, C. M. The application of tungsten carbide to circular saws. Mech. Eng., vol. 52, 1930, p. 681. Describes application of tungsten carbide to removable teeth for circular saws used in cutting stone and metals.

Vereinigte Stahlwerke A.-G. Alliage dur et procédé pour sa fabrication. French Patent 692743, August 5, 1930. Hard alloys of the stellite type containing cobalt, chromium, tungsten, and carbon, with or without molybdenum, nickel, iron, and manganese, are made by using more than 2 per cent of carbon in the form of graphite.

Walter, Richard. Procédé de fabrication d'alliages, au moyen de carbure de tungstène avec des métaux du groupe fer et du groupe chrome. French Patent 685640, April 1, 1930. Hard alloys of tungsten carbide are made in which at least 50 per cent of tungsten carbide is contained, with a metal of high fusion point of the chromium group (chromium, tungsten, molybdenum, uranium) in the proportion of 5 to 3 per cent and for the rest a metal of the iron group; that is, iron, manganese, nickel, or cobalt. The carbide may be replaced partly or completely by a carbonitride.

Wills, H. J. The lapping of tungsten carbide tools. Machinery (London), vol. 36, 1930, pp. 718–719. A lapped cutting edge on a tungsten carbide tool has two to four times the life of a ground edge. The process has not been generally used because of the high cost of diamond dust from $9,000 to $25,000 per pound. A working edge superior to that produced by diamond dust has been produced by an abrasive costing only 70 cents per pound. This is a carborundum finishing compound. The method of lapping with this abrasive is described in detail.

Wissler, W. A. (to Haynes Stellite Co.) Metal-cutting tool and alloy for making the same. U. S. Patent 1774862, September 2, 1930. The alloy contains chromium, 15 to 40; tungsten, 15 to 35; boron, 0.5 to 2.5; and carbon, 0.75 to 2.5 per cent; the remainder (not over about 50 per cent of the total) is mainly nickel.

Wyman, L. L., and Kelley, F. C. Cemented tungsten carbide. A study of the action of the cementing material. Metal Ind., vol. 28, 1930, p. 462. The binding constituent in the cemented tungsten carbide materials usually reaches the liquid state during the final sintering operation, at which time it consists of tungsten carbide dissolved in cobalt. They believe that upon solidifying, this cobalt-rich cementing material remains as a solid solution of tungsten carbide in cobalt.

Zieler, W. Effect of composition on hardness of tungsten steels. Iron Age, vol. 124, 1929, p. 1595. Abstract translation of article in Stahl und Eisen, vol. 49, July 25, 1929, pp. 1083–1084. Annealing and cooling are important in the formation of carbides in this system. In the intermediate and higher tungsten steels, normal cooling favors the formation of a double carbide. With longer time near the critical temperature and slower cooling, the double carbide tends to split off more or less tungsten carbide. Small additions of chromium tend to prevent decomposition and spliting off of tungsten carbide. The phases present may be classified as Fe_3C, Fe_2W, tungsten carbide, and two double carbides.

SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES[1]

(MINE REPORT)

By J. P. Dunlop and H. M. Meyer

CONTENTS

	Page
Introduction	209
Tenor of ores of the Central States	209
Summary	211
Production of lead and zinc by regions	213
Review by States and districts	214
Arkansas	214
Illinois	215
Iowa	217
Review by States and districts—Continued.	
Kansas	218
Kentucky	221
Michigan	221
Missouri	228
Oklahoma	235
Wisconsin	240

INTRODUCTION

The silver, copper, lead, and zinc mines of the Central States are in Arkansas, Illinois, Kansas, Kentucky, Michigan, Missouri, Oklahoma, and Wisconsin. The territory thus embraced lies in the great interior valley province of the United States, which extends from the Appalachian system to the Rocky Mountain front, exclusive of the Black Hills. Most of the mines are in the Paleozoic sedimentary rocks of this province, but the copper range of northern Michigan comprises lavas and intercalated sediments of pre-Cambrian age.

In the lead and zinc regions of the Central States the material sold is mainly concentrates,[2] and payment is made according to a basic price for concentrates of a certain quality. The details of this method are given in the pages devoted to Missouri in the report of this series for 1914. The figures reported by producers represent the quantity and assay contents of concentrates sold and the amount received in payment. The total metal produced is calculated from the first two of these items.

The operators in Michigan report the quantity of concentrates produced and the actual recovery of copper from concentrates smelted. In any year the mines may produce more or less concentrates than are smelted during the same period. The copper content of concentrates produced but not smelted during the year has been estimated on the basis of the average copper recovery per ton for the year of the company producing it.

TENOR OF ORES OF THE CENTRAL STATES

The only fair basis for comparison of the relative magnitude of mining operations in different States is that of quantity of crude ore or "dirt." There are, however, marked differences in the metal content of the ores of the several mining regions and States; therefore, comparison of tenor of the ores is of interest and significance. All but a very small part of the ore from the Central States is of such tenor that it requires concentration. In Kentucky and southern Illinois most of the lead and zinc concentrates are recovered as by-products in the concentration of the fluorspar that they accompany, and it is not possible to calculate the metal content of the crude ore raised. In Arkansas very little ore has been mined for several years, and the average tenor calculated from the output of ore during these years would not present an accurate comparison with the tenor during a period of active mining.

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[1] Work on manuscript completed July, 1931.

[2] In local usage the ore as mined is called "dirt" and the concentrates are classed as "ore." Where the capacity of a concentrating plant is given, such capacity is to be understood as based on a 10-hour shift unless otherwise stated.

Quantity and tenor of copper, lead, and zinc ores, old tailings, etc., produced in the Central States, 1928–1930, by States

State	1928		1929		1930	
	Ore	Metal content [1]	Ore	Metal content [1]	Ore	Metal content [1]
	Short tons	*Per cent*	*Short tons*	*Per cent*	*Short tons*	*Per cent*
Illinois (northern)	(2)	(2)	(2)	(2)	(3)	(3)
Kansas	4, 662, 200	3. 16	5, 321, 100	2. 98	3, 517, 300	2. 86
Michigan	7, 361, 658	1. 21	7, 598, 180	1. 23	6, 659, 036	1. 27
Missouri	6, 573, 800	3. 26	6, 868, 000	3. 13	7, 010, 100	3. 08
Oklahoma	8, 028, 000	2. 97	9, 324, 600	2. 84	7, 213, 600	2. 61
Wisconsin	733, 500	3. 49	607, 100	3. 79	486, 400	3. 66
	27, 359, 158	----------	29, 718, 980	----------	24, 886, 436	----------

[1] The percentages given in this column represent the metal content of the ore in so far as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in the other Central States the metals are lead and zinc, the relative proportions of which are shown in the table on another page and in the tables of tenor of ore given in the sections devoted to the respective States.

[2] No ore milled; concentrates shipped were from ore milled in 1927.

[3] Only a small quantity of old tailings milled in 1930 at one mill.

The large decrease in the quantity of ore treated in 1930 in the Central States was shared by the copper properties in Michigan and the lead and zinc properties in Kansas, Oklahoma, Wisconsin, and southwestern Missouri and was caused by much lower prices and by a lessened demand for metals. Smaller outputs of lead and zinc were also made by mines in Arkansas, Illinois, and Kentucky. The decrease in the quantity of zinc and zinc-lead ore in Wisconsin was about 20 per cent; the tenor of the ore milled also decreased. No lead or zinc ores were mined in Illinois or Kentucky in 1930, and no zinc ore in Arkansas. Crude ore milled in Oklahoma decreased 2,289,800 tons and old tailings milled increased 178,800 tons; this accounts for the lower recovery of concentrates in 1930 than in 1929.

The average tenor of ore treated in the Central States in 1930 is indicated best by the average value of the total metal content recovered, which was $2.74 a ton of ore and old tailings treated. This value was 99 cents less than that in 1929, due partly to the lower average prices of copper, lead, and zinc and partly to the smaller quantities of the metals recovered. The 18,227,400 tons of zinc, lead, and lead-zinc ores, old tailings, etc., exclusive of the small output from Arkansas, Illinois, and Kentucky, treated in the Central States in 1930 yielded lead and zinc concentrates that sold for $33,539,361; consequently, the mine operators realized an average of $1.84 a ton of ore, old tailings, etc., mined, treated, and sold, compared with $2.46 in 1929. Briefly, they realized about 25 per cent less for their product in 1930 than in 1929. The value of both lead and zinc concentrates was much lower in 1930 than in 1929, and a greater proportion of old tailings to crude ore was treated. Seven mills in Missouri reported having flotation units; 116,465 tons of galena concentrates and 8,411 tons of sphalerite concentrates were recovered at these mills in 1930 by the flotation process. Thirty mills in Kansas produced 1,133 tons of galena concentrates and 37,866 tons of sphalerite concentrates by flotation, and 62 mills in Oklahoma recovered 3,686 tons of galena concentrates and 82,390 tons of sphalerite concentrates by flotation. One all-flotation plant was operated in Wisconsin in 1930 for the first time; another plant was under construction.

SUMMARY

The total value of the mine production of silver, copper, lead, and zinc in the Central States was $68,313,236 in 1930, or $42,666,007 less than in 1929. The total value from 1907 to 1930 was $2,393,541,595—$938,883,240 for zinc, $757,151,666 for copper, $690,106,838 for lead, and $7,399,851 for silver. The value of the zinc has been greater than that of the copper for the last 12 years; the total value of the zinc from 1907 to 1930 is $181,731,574 more than that of the copper.

The value of metal production herein reported has been calculated at the figures given in the table that follows. The silver price for 1921 to 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of silver, copper, lead, and zinc in the Central States in 1930, by States

State	Silver		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Pounds	Value	Short tons	Value	Short tons	Value	
Arkansas					53	$5,300			$5,300
Illinois	1,797	$692			248	24,800	9	$864	26,856
Kansas					12,910	1,291,000	74,304	7,133,184	8,424,184
Kentucky					101	10,100			10,100
Michigan	7,820	3,011	169,381,413	$22,019,584					22,022,595
Missouri	170,210	65,531	176,600	22,958	199,632	19,963,200	10,811	1,037,856	21,089,545
Oklahoma					23,052	2,305,200	136,153	13,070,688	15,375,888
Wisconsin					1,537	153,700	12,558	1,205,568	1,359,268
	179,827	69,234	169,558,013	22,042,542	237,533	23,753,300	233,835	22,448,160	68,313,236
Total, 1929	206,133	109,869	186,404,458	32,807,184	273,895	34,510,770	329,935	43,551,420	110,979,243

Silver.—Nearly all of the silver that has been produced in the Central States has been recovered incidentally in the production of other metals. The only silver ore mined in this area in the last 20 years came from Oklahoma; the deposit of ore was small. Michigan formerly produced considerable lump native silver and silver recovered in refining copper, but recently the output has declined rapidly and was only 7,820 ounces in 1930; none was obtained from refining bullion. The silver derived from the treatment of lead ore from southeastern Missouri decreased 11,428 ounces in 1930. Most of the silver credited to Missouri is now derived from zinc concentrates from lead ores and not, as formerly, from the refining of lead bullion. The lead-zinc fluorspar deposits of the Kentucky-Illinois field also carry silver; the quantity of silver recovered from the lead concentrates shipped from Illinois in 1930 was 1,797 ounces, a decrease of 1,903 ounces from 1929. This decrease was caused by dullness in the fluorspar industry.

Copper.—The mine production of copper in the Central States in 1930—169,558,013 pounds—was all from Michigan except 176,600 pounds from lead-copper matte from southeastern Missouri lead ores. None of the copper mines in Missouri shipped copper ore in 1930; the copper mines in Michigan decreased their output of copper ore 939,144 short tons and their output of copper 17,020,805 pounds.

Lead.—The mine shipments of lead in the Central States in 1930 decreased 13.3 per cent in quantity and 31.2 per cent in value. In 1930 Missouri produced 84 per cent of the total, and the recovered lead content of galena and lead carbonate concentrates mined and shipped in Missouri in 1930 was equivalent to 35 per cent of the refined primary lead recovered in the United States from domestic ore during that year. Of the total output of lead in Missouri the disseminated lead district of southeastern Missouri produced 198,622 tons, or more than the output of any other State or district in the United States. Southwestern Missouri had an output of 1,010 tons of lead, or 24 tons less than in 1929. The production of lead in Oklahoma, as measured by the recovered metal in concentrates shipped, decreased from 46,513 tons in 1929 to 23,052 tons in 1930. The shipments from Kansas mines decreased from 26,596 tons in 1929 to 12,910 tons in 1930, and those from Wisconsin mines were about the same in 1930 as in 1929. Production from Illinois mines decreased from 443 tons in 1929 to 248 tons in 1930, and that from Kentucky mines decreased from 287 tons in 1929 to 101 tons in 1930. The combined output of lead in 1930 from mines in Arkansas, Illinois, Kentucky, and Wisconsin amounted to less than 1 per cent of the total output of the Central States.

Zinc.—The mine production of zinc in the Central States in 1930 was equivalent to 48 per cent (54 per cent in 1929) of the total smelter output of primary slab zinc from domestic ore in the United States. Oklahoma produced 136,153 tons of zinc in 1930, compared with 192,042 tons in 1929. For many years prior to 1918 Missouri was the largest producer of zinc in the United States; in 1930, however, the output from Missouri mines was only 10,811 tons, whereas in 1917 it was 132,918 tons. The output of zinc in Kansas was 74,304 tons in 1930—52,003 tons less than in 1926, the year of largest output. In Wisconsin many of the mines were idle, and the output of zinc declined from 16,986 tons in 1929 to 12,558 tons in 1930. The zinc output of Illinois decreased from 31 tons in 1929 to 9 tons in 1930. Arkansas and Kentucky shipped no zinc ore or concentrates in 1930. Iowa has reported no lead or zinc shipments for many years.

PRODUCTION OF LEAD AND ZINC BY REGIONS

The productive lead and zinc territory in the Central States falls naturally into seven regions, three of which are not limited to a single State. For statistical purposes the tables showing the production of lead and zinc by States are necessary, but for practical purposes it is desirable to show the production by the natural regions, irrespective of State lines.

The seven regions, in order of size of output, are: (1) The Joplin region, comprising southwestern Missouri, southeastern Kansas, and northeastern Oklahoma; (2) southeastern Missouri, containing the great deposits of disseminated lead; (3) the upper Mississippi Valley region, including all the lead and zinc mines in southwestern Wisconsin, Iowa, and northwestern Illinois; (4) the fluorspar region in southern Illinois and western Kentucky; (5) Arkansas; (6) central Missouri; (7) the Arbuckle Mountain region, in southern Oklahoma.

The southeastern Missouri region produced 83.6 per cent of the lead output of the Central States and 35 per cent of the primary lead recovered from domestic ore smelted or refined in the United States in 1930. The Joplin region yielded 15.6 per cent of the lead and 92.8 per cent of the zinc of the Central States in 1930 and was much the largest producer of zinc in the United States, yielding 44.3 per cent of the total slab zinc produced from domestic ores in 1930 and 51 per cent of the total in 1929.

The lower zinc content of the zinc concentrates produced at mines in the upper Mississippi Valley region is clearly indicated by the fact that, although these mines yielded 11 per cent of the total output of raw zinc concentrates of all classes, the zinc content of such concentrates was only 5 per cent of the zinc from mines in the Central States.

The lead content of the galena concentrates shipped from the upper Mississippi Valley region averaged about 73.5 per cent, that of the concentrates from the Joplin region averaged about 77 per cent, and that of the concentrates from the southeastern Missouri region averaged 73 per cent. A very small proportion of the galena shipped from the Joplin region contained more than 82 per cent of lead. A large part of the sphalerite shipped from the Joplin region contained 58 to 60 per cent of zinc, and about 25,000 tons from districts in that region averaged 61 per cent.

Mineral Resources for 1914 contains brief reviews of the history of lead and zinc mining in the Central States, the yearly production of each State for the period 1907 to 1914, inclusive, and historical notes and estimates of the total production of lead and zinc in each State before 1907.

Mine production of lead and zinc in the Central States in 1930, by regions

Region	Lead [1]		Zinc [2]		Total value
	Short tons	Value	Short tons	Value	
Concentrates:					
Joplin	48, 960	$3, 206, 589	419, 385	$12, 815, 587	$16, 022, 176
Southeastern Missouri	277, 520	16, 558, 920	8, 411	158, 116	16, 717, 036
Upper Mississippi Valley [3]	2, 133	129, 925	51, 554	670, 612	800, 537
Kentucky-southern Illinois	563	26, 631			26, 631
Northern Arkansas	68	4, 033			4, 033
	329, 244	19, 926, 098	479, 350	13, 644, 315	33, 570, 413
Total, 1929	378, 237	29, 452, 641	676, 048	25, 035, 085	54, 487, 726
Metal:					
Joplin	36, 972	3, 697, 200	216, 961	20, 828, 256	24, 525, 456
Southeastern Missouri	198, 622	19, 862, 200	4, 307	413, 472	20, 275, 672
Upper Mississippi Valley [3]	1, 537	153, 700	12, 567	1, 206, 432	1, 360, 132
Kentucky-southern Illinois	349	34, 900			34, 900
Northern Arkansas	53	5, 300			5, 300
	237, 533	23, 753, 300	233, 835	22, 448, 160	46, 201, 460
Total, 1929	273, 895	34, 510, 770	329, 935	43, 551, 420	78, 062, 190

[1] Includes both galena and a small quantity of lead carbonate concentrates.
[2] Includes sphalerite and a small quantity of zinc carbonate and zinc silicate concentrates.
[3] Includes Iowa, northern Illinois, and Wisconsin.

REVIEW BY STATES AND DISTRICTS

ARKANSAS

By J. P. Dunlop

The value of the lead and zinc from Arkansas mines was only $5,300 in 1930, compared with $1,430,668 in 1917.

The production of galena in Arkansas is small. No zinc carbonate and zinc silicate concentrates were shipped in 1930.

Mine production of lead and zinc in Arkansas, 1921–1930

Year	Lead concentrates (galena)		Zinc concentrates				Metal content [1]			
			Sphalerite		Silicate and carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	27	$1, 510			42	$580	21	$1, 890	15	$1, 500
1922	55	4, 000			425	6, 870	42	4, 620	134	15, 276
1923	32	2, 559			444	9, 919	25	3, 500	148	20, 128
1924	25	2, 730			13	330	20	3, 200	4	520
1925	93	8, 546	58	$2, 380	44	1, 296	58	10, 092	43	6, 536
1926	28	2, 544	8	346	246	7, 012	18	2, 880	87	13, 050
1927	30	2, 590			386	9, 453	23	2, 898	128	16, 384
1928	50	4, 010			224	5, 600	38	4, 408	86	10, 492
1929	66	5, 500			25	605	51	6, 426	9	1, 188
1930	68	4, 033					53	5, 300		

[1] In calculating the metal content of the ores from assays, allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Arkansas, 1927–1930

	1927	1928	1929	1930
Total ore……short tons	(1)	(1)	(1)	(1)
Average lead content of galena concentrates……per cent	78	76	78.8	80.0
Average zinc content of zinc silicate and carbonate……do	38	43	40.2	----------
Average value per ton:				
Galena concentrates	$86.33	$80.20	$83.33	$59.31
Zinc silicate and carbonate	$24.49	$25.00	$24.20	----------

[1] The quantity of ore mined was very small, and very little of it was milled, so that no calculations as to tenor are available; part of the ore sold was taken from stock in bins.

The mines are chiefly in Boone and Marion Counties and the adjoining portions of Searcy and Newton Counties, but there are numerous prospects in Baxter, Izard, Sharp, Lawrence, and other counties to the east, and deposits have been worked in Washington and Sevier Counties, on the extreme western border of the State, and in Pike County, in the southwestern part of Arkansas.

The ores are galena, sphalerite, and smithsonite, and the concentrates produced are generally of high grade and free or nearly free from iron or lime. The sphalerite and smithsonite are shown by analysis to contain appreciable quantities of cadmium, especially in a yellow variety of smithsonite known locally as "turkey fat," which shows as much as 0.8 per cent of cadmium. This was the highest content reported for zinc concentrates for the Central States until 1927, when shipments of blende concentrates from southeastern Missouri were reported as assaying 1 per cent of cadmium.

In 1930 only two lead and zinc mines were operated in Arkansas, and no development of importance took place. All the galena concentrates shipped in 1930 were from the Brewer land near Ponca in Newton County. The Morning Star mine and mill and other properties near Rush were idle. The only mining reported in Lawrence County was that by the Arkansas Oklahoma Mining & Milling Co., which opened a deposit of zinc carbonate on the Gibson land near Imboden. A 90-ton mill was under construction. No zinc carbonate was shipped in 1930.

ILLINOIS

By J. P. Dunlop

Mine production of lead and zinc in Illinois in 1930, by districts [1]

District	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Northern Illinois	--------	----------	30	$388	--------	----------	9	$864
Southern Illinois	379	$19,520	--------	----------	248	$24,800	--------	----------
	379	19,520	30	388	248	24,800	9	864
Total, 1929	668	51,072	112	1,962	443	55,818	31	4,092

[1] Mineral Resources for 1914 contains a historical review of lead and zinc mining in Illinois.

[2] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Illinois, 1927–1930

	1927	1928	1929	1930
NORTHERN ILLINOIS				
Total ore ..... short tons	88, 200	(1)	(2)	(2)
Total concentrates in ore:				
Lead ..... per cent	0. 12	-----	-----	-----
Zinc ..... do	3. 09	-----	-----	-----
Metal content of ore:				
Lead ..... do	. 08	-----	-----	-----
Zinc ..... do	. 74	-----	-----	-----
Average lead content of galena concentrates ..... do	66. 4	78. 0	-----	-----
Average zinc content of sphalerite concentrates ..... do	23. 6	27. 5	36. 0	38. 7
Average value per ton:				
Galena concentrates	$72. 74	$76. 46	-----	-----
Sphalerite concentrates	$11. 27	$11. 94	$17. 52	$12. 93
SOUTHERN ILLINOIS				
Average lead content of galena concentrates ..... per cent	67. 4	65. 4	67. 7	66. 8
Average value per ton of galena concentrates	$70. 23	$73. 81	$76. 46	$51. 50

[1] Concentrates shipped were milled in 1927.

[2] Old tailings only treated.

Mine production of silver in southern Illinois, 1921–1930

Year	Silver		Lead concentrates, silver-bearing		Year	Silver		Lead concentrates, silver-bearing	
	Fine ounces	Value	Short tons	Ounces of silver per ton		Fine ounces	Value	Short tons	Ounces of silver per ton
1921	1, 345	$1, 345	181	7. 43	1926	2, 990	$1, 866	614	4. 87
1922	6, 025	6, 025	1, 100	5. 48	1927	1, 518	861	310	4. 90
1923	8, 170	6, 699	1, 762	4. 64	1928	3, 146	1, 840	589	5. 34
1924	8, 891	5, 957	1, 678	5. 30	1929	3, 700	1, 972	668	5. 54
1925	3, 000	2, 082	797	3. 76	1930	1, 797	692	379	4. 74

The value of the mine production of silver, lead, and zinc in Illinois in 1930 was $26,356, compared with $61,882 in 1929.

The lead and zinc deposits of Illinois fall into two distinct regions marked by different mineral associations and structural environment. Those of southern Illinois belong to the Kentucky-Illinois fluorspar district; those of northern Illinois belong to the upper Mississippi Valley region.

NORTHERN ILLINOIS

The lead and zinc mines of northern Illinois are all in Jo Daviess County, the extreme northwestern county of the State. The ores are galena, smithsonite, and sphalerite, although the first two are much less common now than formerly when most of the deposits worked were shallow and above water level.

The entire output of northern Illinois is included under the Galena district, which comprises the mines from the vicinity of Fever River to the Wisconsin State line.

Only one tailing mill was operated in northern Illinois in 1930, no ore was mined, and little prospect drilling was done. The shipments were 30 tons of sphalerite concentrates made by the Hollander tailing mill.

SOUTHERN ILLINOIS

The lead and zinc deposits of southern Illinois are in Pope and Hardin Counties; they occur in rocks of Mississippian age in the northern extension of the Kentucky-Illinois fluorspar district. The chief product of the mines in recent years has been fluorspar, and the yield of galena is small compared with the output from other districts in the Central States.

The total production of galena concentrates in southern Illinois from 1906 to 1930 has been 17,788 tons, most of which has been shipped from the Fairview, Rosiclare, and Hillside mines. The shipments of zinc ores from the district have been comparatively small and scattered. The only recorded shipments of zinc carbonate, aggregating 103 tons, were made from the Empire mine in 1903 or 1904 and from four companies in 1906.

Formerly large bodies of galena near the surface were worked, but galena is now produced incidentally in the concentration of the fluorspar; for this reason it would be misleading to give the quantity of crude ore. The galena of southern Illinois is notably argentiferous as compared with the rest of the Mississippi Valley ores, and the silver content averaged 3.76 to 7.43 ounces to the ton of lead concentrates for the last 14 years.

The first large shipments of sphalerite in many years were made in 1924 frcm the 250-ton plant of the Fairview Fluorspar & Lead Co., which reported no sales of sphalerite from 1926 to 1930.

The quantity of galena concentrates shipped from southern Illinois decreased from 668 tons in 1929 to 379 tons in 1930. Most of the output was from the property of the Hillside Fluor Spar Mines near Rosiclare. The ore from the Hillside mine is milled at a 250-ton plant equipped with a washing screen, a picking belt, tables, and jigs. The Hillside mill was operated on a reduced scale owing to smaller demand for fluorspar. The galena concentrates, assaying 66.5 per cent of lead and about 5 ounces of silver a ton, were shipped to the St. Louis plant of the National Lead Co. The Rosiclare mine also shipped silver-bearing galena concentrates in 1930, having a lead content of 69 per cent. The Rosiclare mill was operated on a 4-day week schedule only in 1930; its output of galena was less than normal. The Franklin Fluorspar Mining Co. shipped no galena from its Illinois properties in 1930.

IOWA

The lead and zinc deposits of Iowa extend along the Mississippi River for nearly 80 miles, in Dubuque, Clayton, and Allamakee Counties. No shipments of lead or zinc concentrates from mines in Iowa have been reported since 1917.

KANSAS

By J. P. Dunlop

Mine production of lead and zinc in Kansas in 1930, by districts

District	Lead concentrates [1]		Zinc concentrates		Metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Blue Mound-Baxter Springs	14,866	$1,013,339	131,290	$4,124,643	11,239	$1,123,900	68,210	$6,548,160
Crestline	1,841	118,044	3,546	103,680	1,510	151,000	1,756	168,576
Galena	228	12,436	15	367	161	16,100	7	672
Waco			8,497	251,882			4,331	415,776
	16,935	1,143,819	143,348	4,480,572	12,910	1,291,000	74,304	7,133,184
Total, 1929	34,393	2,961,776	210,253	8,551,183	26,596	3,351,096	109,850	14,500,200

[1] Includes 63 tons of lead carbonate, containing 58.7 per cent lead, from Galena.

[2] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1929 and 1930

	1929		1930	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled short tons	4,182,600	1,138,500	2,355,100	1,162,200
Total concentrates recovered:				
Galena do	34,143	209	19,758	165
Sphalerite do	193,916	16,337	128,367	14,981
Ratio of concentrates to ore, etc.:				
Lead per cent	0.80	0.02	0.84	0.01
Zinc do	4.92	1.44	5.45	1.29
Metal content of ore, etc.:				
Lead do	.63	.01	.65	.01
Zinc do	2.93	.82	3.23	.73
Average lead content of galena concentrates do	79.1	60.8	77.9	55.1
Average zinc content of sphalerite concentrates do	59.5	57.1	59.2	56.5
Average value per ton:				
Galena concentrates	$86.36	$67.00	$67.87	$42.94
Sphalerite concentrates	$41.12	$35.31	$31.80	$25.90

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1927–1930

	1927	1928	1929	1930
Total ore and old tailings milled short tons	4,505,800	4,662,200	5,321,100	3,517,300
Total concentrates in ore, etc.:				
Lead per cent	0.79	0.69	0.63	0.57
Zinc do	4.70	4.33	4.18	4.10
Metal content of ore, etc.:				
Lead do	.62	.55	.50	.44
Zinc do	2.76	2.61	2.48	2.42
Average lead content of galena concentrates do	78.9	79.6	79.0	77.7
Average zinc content of sphalerite concentrates do	58.8	59.0	59.3	58.9
Average value per ton:				
Galena concentrates	$88.30	$80.90	$86.08	$67.63
Sphalerite concentrates	$39.88	$37.60	$40.70	$31.26

The lead and zinc deposits of Kansas, so far as developed, are limited to Cherokee County in the southeastern part of the State. They form the western extension of the ore deposits of the Joplin region and display the general characteristics shown in that region, except that here typical sheet-ground deposits have not been extensively developed.

It is difficult to ascertain the production for early years or to segregate the Kansas ores from those produced in the Missouri portion of the Joplin region. If to the figures for 1886 to 1903, published by the Kansas Geological Survey,[3] are added those for 1904 to 1930 published in Mineral Resources of the United States, a total of 3,145,191 tons of zinc concentrates and 481,431 tons of lead concentrates is shown as the approximate production of Kansas from 1886 to 1930. About 44 mines, of which 35 are in the Blue Mound-Baxter area, shipped lead or zinc in 1930.

The shipments of lead and zinc from the Galena camp continued small in 1930. Most of the production came from the Blue Mound-Baxter Springs district, an extension of the Miami field. Smaller and decreased outputs of lead and zinc came from the Crestline and Waco districts. Mines on the Kansas side of the Waco camp shipped 8,497 tons of sphalerite in 1930, or 6,290 tons less than in 1929. Mines in the Crestline district shipped 1,841 tons of galena concentrates in 1930, or 2,200 tons less than in 1929. Shipments of sphalerite from mines in the Blue Mound-Baxter Springs area decreased substantially. Total shipments of zinc concentrates from mines in Kansas in 1930 decreased 66,905 tons; total shipments of galena concentrates from mines in Kansas decreased 17,521 tons, due to small shipments from Crestline and to stocks held at mines in the Blue Mound-Baxter Springs area.

Blue Mound-Baxter Springs district.—The shipments of concentrates from the Blue Mound-Baxter Springs area in 1930 amounted to 14,866 tons of galena and 131,290 tons of sphalerite, compared with 30,046 tons of galena and 188,294 tons of sphalerite in 1929. The average lead content of the galena sold in 1930 was 77.1 per cent, and the zinc content of the sphalerite was 59 per cent. The quantity of crude ore milled decreased, but a larger quantity of old tailings was treated in 1930. The crude ore (old tailings excluded) milled in 1930 yielded 6.96 per cent in concentrates, compared with 6.07 per cent in 1929. About 67 per cent of the galena and 82 per cent of the sphalerite shipped from this area came from mines in the vicinity of Blue Mound; these mines shipped 10,022 tons of galena and 107,554 tons of sphalerite. The mines north of Hockerville, Zincville, and near Baxter Springs in Kansas shipped 4,844 tons of galena and 23,736 tons of sphalerite. Several thousand tons of galena produced in 1930 were not sold.

Little prospecting was done in the Blue Mound-Baxter Springs area. Development was cut to the minimum, and there was no extension of the limits of the district. Few mills were built, and several large milling plants, such as the Paxton, Velie, and Hartley, were idle in 1930. The Ballard 800-ton mill was operated only a short time. The Otis Mining Co. 200-ton mill was completed and operated.

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[3] Haworth, Erasmus, and others, History, Geography, and Metallurgy of Galena-Joplin Lead and Zinc: Univ. Kansas Geol. Survey, vol. 8, 1904.

The option of the Canam Metal Co. on the Harrington mine was not exercised. The Lucky Jew mine was operated part of the year by Fred Childress and then sold to the Jay Hawk Mining Co., which continued operations. The Kansouri lease was taken over by the Pot Luck Mining Co. and worked during the latter half of 1930.

The producing properties near Baxter Springs in 1930 were the Ballard, Boska No. 2, Brugger, Campbell, Hartley-Grantham, Paxton, Peru, Peru-Laclede (tailings), Race Track, and Vantage No.2. The producing properties in the Blue Mound area were the Barr, Bendelari, B H & E (tailings), Black Eagle, Boska No. 1, Cherokee, Chubb, Jay Hawk, King Brand, Mid Continent, Pot Luck, Robinson, Tri State (tailings), Webber, West Side, and Wilbur.

The mines that shipped more than 500 tons each of galena in 1930 were the Ballard, Barr, Bendelari, Big John, Black Eagle, Boska No. 1, Boska No. 2, Brugger, Mid Continent, Peru, Robinson, Webber, and Wilbur.

The mines that shipped more than 3,000 tons each of sphalerite in 1930 were the Bendelari, Black Eagle, Campbell, Cherokee, Chubb, Hartley-Grantham, Jarrett (Federal), Jarrett (Kansas Exploration, Inc.), Mid Continent, Peru, Robinson, Webber, West Side, and Wilbur.

Crestline district.—The production of the Crestline district in 1930 was 1,841 tons of galena and 3,546 tons of sphalerite, compared with 4,041 tons of galena and 6,943 tons of sphalerite in 1929. Most of the mines were idle part of 1930, and no new work was done.

The Crutchfield mine was the largest producer, although its output was less in 1930 than in 1929. The Glendale mine was operated steadily and yielded its normal output . The two 300-ton mills of the Crestline Products & Service Co. were operated for a few months partly on ore and partly on tailings; both mills were then closed.

Galena district.—The production of lead concentrates in the Galena district in 1930 was 165 tons of galena and 63 tons of lead carbonate, compared with 204 tons of galena and 102 tons of lead carbonate in 1929. The shipments of sphalerite concentrates decreased from 229 tons in 1929 to 15 tons in 1930.

The lead concentrates were produced by small operators working on upper levels or culling from old dumps, mainly on the Southside land. The old mining area is flooded, and no effort was made in 1930 to unwater it. The Eagle-Picher Lead Co. has offered to drain the old mining area provided it is tendered leases on all the land.

Waco district.—The total output of the Waco district in 1930 was 16,501 tons of sphalerite and 72 tons of galena, compared with 23,349 tons of sphalerite in 1929. The district lies partly in Missouri and partly in Kansas; shipments from the Kansas side of the district in 1930 amounted to 8,497 tons of sphalerite, compared with 14,787 tons in 1929. The entire output in both 1929 and 1930 came from the mines of the Missouri-Kansas Zinc Corporation and from old tailings milled by the same operator. Four shafts were used to hoist ore, mainly from the 250-foot level. Each of the two mills has a capacity of 500 tons. The large flotation plant equipped with ball mills and 10 Butchart flotation machines produced about 40 per cent of the concentrates.

KENTUCKY

By J. P. Dunlop

Lead and zinc deposits occur in both central and western Kentucky. The central districts have not reported any shipments of lead or zinc for more than a score of years. The deposits in the fluorspar region of western Kentucky are chiefly in Crittenden, Caldwell, and Livingston Counties and form a continuation of those in the southern Illinois lead and zinc region.

Considerable quantities of galena ores have been produced in former years, but at present lead is obtained solely as a by-product in the recovery and concentration of fluorspar, which is the principal economic mineral. The galena recovered is argentiferous, and its silver content ranges from a very small quantity to more than 3 ounces a ton, but no recovery of this silver content has been reported by the smelters for many years.

Mine production of lead and zinc in Kentucky, 1921–1930

Year	Lead concentrates (galena)		Zinc concentrates				Metal content			
			Sphalerite		Zinc carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	100	$3, 693	--------	--------	621	$19, 800	69	$6, 210	220	$22, 000
1922	132	8, 365	--------	--------	419	8, 373	92	10, 120	142	16. 188
1923	78	6, 152	--------	--------	850	17, 925	53	7, 420	270	36, 720
1924	259	22, 908	--------	--------	1, 494	37, 000	175	28, 000	492	63, 960
1925	251	23. 619	--------	--------	1, 217	29, 740	152	26, 448	429	65, 208
1926	92	7, 537	582	$17, 471	4, 478	116, 417	58	9, 280	1, 838	275, 700
1927	241	14, 070	352	5, 392	2, 136	46, 514	139	17, 514	860	110, 080
1928	59	4, 959	--------	--------	265	6, 032	39	4, 524	92	11, 224
1929	496	29, 623	--------	--------	--------	--------	287	36, 162	--------	--------
1930	184	7, 111	--------	--------	--------	--------	101	10, 100	--------	--------

The total value of the lead concentrates shipped from Kentucky mines in 1930 was $7,111, compared with $29,623 in 1929; no zinc concentrates were shipped in either year. The Franklin Fluorspar Co. was the largest shipper in 1930; other shippers were the Eagle Fluor Spar Co., Lafayette Fluorspar Co., Kentucky Fluorspar Co., Holly Fluorspar Co., and Zinc & Spar Co. Some of the fluorspar mines report that the crude ore contains about 1 per cent of galena. The Hudson and the Sheridan mines, both of which have sphalerite ore in the lower workings and have had good outputs of zinc carbonate ore, are reported to be for sale.

MICHIGAN

By H. M. Meyer

The output of refined copper in Michigan decreased in 1930 for the first time since 1924. This decrease was caused by the severe decline in consumption of copper, which resulted from the general industrial depression that began in 1929, and by the precipitous drop in the price of copper, which at one time during the year was only a little more than half the average for 1929. At its low point the price of copper was less than the cost of production at most of the Michigan mines and, in addition to the difficulty of disposing of the metal in the restricted market, the producers were unwilling to sell their output at less than the cost of production. Near the end of the year, therefore, the rate of production was greatly curtailed. The decline in the rate of production was brought about by a reduction in the number of laborers at the mines and by a reduction in the length of the working week to five and in some cases to four days. Stocks of refined copper increased considerably during the year, and at one property a large part of the mineral produced was held in stock and not smelted. Costs of production were reduced, largely at the expense of labor which had previously received the benefit of the high price for copper that prevailed prior to beginning of the depression. The average yield of copper per ton of "rock" treated was 1.27 per cent in 1930, the highest recorded since 1923.

Mine production of silver and copper in Michigan, 1921–1930 [1]

Year	Silver (fine ounces)	Copper [2]			Concentrate ("mineral") [3]		Ore [4] ("rock") (short tons)
		Pounds	Yield		Pounds	Yield (per cent)	
			Pounds per ton of ore ("rock")	Per cent			
1921	310, 727	86, 370, 028	23. 9	1. 19	148, 024, 931	58. 4	3, 610, 648
1922	376, 990	121, 712, 365	24. 6	1. 23	193, 984, 975	62. 7	4, 952, 264
1923	223, 997	138, 304, 080	25. 8	1. 29	220, 055, 091	62. 8	5, 363, 160
1924	130, 381	135, 662, 605	25. 3	1. 26	213, 779, 365	63. 5	5, 372, 572
1925	139, 499	155, 157, 488	22. 0	1. 10	241, 056, 386	64. 4	7, 056, 751
1926	105, 242	175, 381, 565	23. 0	1. 15	272, 365, 636	64. 4	7, 611, 682
1927	97, 193	177, 537, 775	22. 1	1. 10	275, 460, 828	64. 5	8, 046, 334
1928	17, 153	178, 442, 704	24. 2	1. 21	283, 405, 073	63. 0	7, 361, 658
1929	20, 795	186, 402, 218	24. 5	1. 23	286, 583, 602	65. 0	7, 598, 180
1930	7, 820	169, 381, 413	25. 4	1. 27	258, 005, 986	65. 7	6, 659, 036

[1] The figures are based on the actual recovery of copper from "mineral" smelted and the estimated recovery from "mineral" that was not smelted during the year.

[2] Includes copper from sands.

[3] Includes "mineral" from sands.

[4] Includes sands.

Value of silver and copper produced in Michigan mines, 1921–1930

Year	Silver	Copper		Total	Year	Silver	Copper		Total
		Total	Per ton of ore ("rock")				Total	Per ton of ore ("rock")	
1921	$310, 727	$11, 141, 734	$3. 09	$11, 452, 461	1926	$65, 671	$24, 553, 419	$3. 21	$24, 619, 090
1922	376, 990	16, 431, 169	3. 32	16, 808, 159	1927	55, 109	23, 257, 449	2. 89	23, 312, 558
1923	183, 678	20, 330, 700	3. 79	20, 514, 378	1928	10, 035	25, 695, 749	3. 49	25, 705, 784
1924	87, 355	17, 771, 801	3. 31	17, 859, 156	1929	11, 084	32, 806, 790	4. 32	32, 817, 874
1925	96, 812	22, 032, 363	3. 13	22, 129, 175	1930	3, 011	22, 019, 584	3. 31	22, 022, 595

F. G. Pardee, mine appraiser of Michigan, has issued a statement covering the cost of producing copper in Michigan in 1930 and for the period 1926–1930, inclusive. The average gross cost for the district (mines only) was 12.5077 cents a pound for 1930, a noteworthy decrease from the cost of 13.6936 cents in 1929 and lower than the cost of 12.5626 cents a pound for 1926–1930, inclusive. The decrease in the cost item for labor, 0.5152 cent a pound in 1930, was the principal factor in the decrease in total cost of production, as it was the principal factor in increase of copper costs in Michigan in 1929. Cost of supplies was next in importance in decreasing costs and accounted for a drop of 0.4376 cent a pound. All cost items showed decreases in 1930 with the exception of general property and State corporation taxes, general office expenses, and concentration. Of this group the largest increase was in general property tax, which amounted to 0.0493 cent a pound.

The important decrease in cost of production, however, was far from enough to counteract the fall in the price received for refined copper during 1930. The average price received for copper in the Lake Superior district, according to Pardee, fell from 17.8511 cents a pound in 1929 to 12.4647 cents in 1930. The drop in price in 1930 converted the average profit of 4.1575 cents a pound received in 1929 to an average loss of 0.043 cent a pound, despite the drop of 1.1859 cents in cost of production. The details of the cost in 1930 are shown in the following statement taken from Pardee's report:

Average cost per pound of Michigan copper production in 1930

	Cents per pound
General expense:	
General property tax	0. 4923
State corporation tax	. 0579
Depreciation	1. 2765
General office	. 1419
Other general expense	. 5229
	2. 4915
Mining cost:	
Labor	4. 8832
Supplies	2. 3815
	7. 2647
Treatment cost:	
Transportation (rock to mill)	0. 4099
Concentrating	1. 3021
Transportation to smelter	. 0319
Smelting and refining	. 5862
	2. 3301
Selling and delivery expense	. 4214
Other costs:	
Construction and installation of equipment	0. 9099
Income tax	. 0413
Average price of copper	12. 4647
Average loss	. 0430
Gross cost	12. 5077

The valuations of copper properties, as given in Pardee's report, follow. The valuation of the Ahmeek mill and railroad was increased and that of two or three of the smaller mines remained stationary. With these exceptions, however, the valuations of all properties were substantially lower in 1930 than in 1929.

Houghton County:	
Calumet & Hecla Consolidated Copper Co.—	
Ahmeek mill and railroad	$1,000,000
Centennial	150,000
Calumet & Hecla conglomerate	2,650,000
Osceola	1,500,000
North Kearsarge	150,000
Reclamation	9,200,000
	14,650,000
Copper Range Co.—	
Champion mine	2,650,000
Baltic mine	90,000
Trimountain	25,000
	2,765,000
Isle Royale Copper Co	950,000
Quincy Mining Co. (including railroad)	900,000
Arcadian Consolidated Copper Co	50,000
Franklin Mining Co	100,000
Mayflower-Old Colony Copper Co	
Hancock Consolidated Copper Co	49,000
La Salle Copper Co	80,000
Superior Copper Co	20,000
Winona Copper Co	65,000
Total, Houghton County	19,629,000
Keweenaw County:	
Calumet & Hecla Consolidated Copper Co.—	
Cliff & Phoenix	75,000
Ahmeek & Allouez	5,500,000
Mohawk Mining Co	1,850,000
Seneca Copper Mining Co	700,000
Douglass Copper Co	40,000
Total, Keweenaw County	8,165,000
Grand total, Houghton and Keweenaw Counties	27,794,000

During 1930 the mines of the Calumet & Hecla Consolidated Copper Co. produced 87,898,000 pounds of copper at an average cost sold (not including depreciation and depletion) of 10.56 cents a pound, compared with 90,319,000 pounds produced in 1929 at an average cost sold of 11.43 cents a pound. In addition, 17,842,000 pounds of copper was recovered at the reclamation plants at Lake Linden and Hubbell at an average cost sold of 6.71 cents a pound, compared with 33,511,000 pounds at an average cost sold of 5.62 cents a pound in 1929. The company reports that it received 12.09 cents a pound for the copper sold during the year. Neither of the reclamation plants was operated continuously during the year; one was shut down for three weeks and the other for six weeks during the summer owing to the lack of electric power due to the shutting down of the turbines at Lake Linden. Both were closed for the winter in November because of the accumulation of copper stocks. The combined results for the two plants for 1930 and for the entire period of their operation is shown as follows:

Operations at the Calumet & Hecla reclamation plants at Lake Linden and Hubbell in 1930 and for the entire period of their operation

	1930	Since starting
Quantity treated .... short tons	1,545,000	24,768,000
Assay headings .... per cent	0.665	0.680
Assay tailings .... do	.086	.137
Refined copper produced .... pounds	17,842,000	268,641,000
Refined copper produced per ton treated .... do	11.55	10.85

Of the total shown for 1930, 4,889,000 pounds was from table treatment following grinding, 10,452,000 pounds from leaching, and 2,501,000 pounds from flotation. The Calumet mill was operated at capacity and treated 841,731 tons of conglomerate rock and 169,356 tons of Osceola amygdaloid; the Ahmeek mill treated 1,193,704 tons of Kearsarge and 571,884 tons of Osceola amygdaloid; and the Lake No. 2 mill treated 157,440 tons of Osceola amygdaloid rock and all the rock of the Seneca Copper Mining Co., which amounted to 227,640 tons. One stamp unit at the Ahmeek mill has been equipped for fine grinding of all jig tailings with recovery of released copper by flotation. The tonnage and quality of rock from the Kearsarge lode will govern the number of units to be equipped similarly in the future, as Osceola lode rock is not rich enough to warrant such installation. At the end of the year a new boiler and power plant was being erected at the Ahmeek mill to furnish steam for existing stamps and pumps and for new turbines of 8,750-kw capacity. The company expects that the operation of this plant will decrease costs of steam and electric power and that the additional generator capacity will be needed when normal operations are resumed at mines and reclamation plants. The milling method and cost at the conglomerate mill of the Calumet & Hecla Consolidated Copper Co. have been described by Benedict.[4] The Lake No. 2 mill of the Lake Milling, Smelting & Refining Co. was closed on December 1, because of the cessation of operations by the Seneca Copper Mining Co. and because of the ample capacity of the Calumet and Ahmeek mills for treating production at that time. The smelter received 85,000 tons of concentrates and mass and smelted 75,900 tons, all from mines and mills of the company, and produced 90,260,000 pounds of refined copper. The dullness in the copper market in 1930 caused reduction of the working week at Calumet & Hecla mines to five days about the middle of September and to four days about the middle of November, when operations at the Lake Linden and Tamarack (Hubbell, Mich.) reclamation plants were suspended. On July 1, 1930, wages were reduced to rates existing before the raise of March 1, 1929. Dividends totaled $3,008,253, $1.50 a share, compared with $9,024,759, $4.50 a share, in 1929.

The Isle Royale Copper Co. treated 510,262 tons of rock during the year, from which 10,659,413 pounds of refined copper, or 20.89 pounds to the ton, was obtained, compared with 515,024 tons of rock treated in 1929, yielding 10,864,085 pounds of copper, or 21.09 pounds to the ton. The average cost of copper sold (not including depreciation and depletion) was 12.97 cents a pound in 1930, and the average price received for copper sold during the year was 11.92 cents a pound. Remodeling was continued at the Isle Royale mill. The Hodge jigs and hydraulic classifiers have been superseded by Woodbury jigs and Dorr drag classifiers, and the Hardinge pebble mill has been replaced by a ball mill of the same design but of greater capacity. The working time at this mine was reduced to a 4-day week basis beginning November 20. The company paid one dividend amounting to $75,000 during the first quarter of 1930, compared with dividends totaling $300,000 paid in 1929.

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[4] Benedict, C. H., Milling Method and Cost at the Conglomerate Mill of the Calumet & Hecla Consolidated Copper Co.: Inf. Circ. 6364, Bureau of Mines, November, 1930, 24 pp.

Copper produced by the Isle Royale Copper Co., 1927–1930

	1927	1928	1929	1930
Rock hoisted short tons	593, 594	560, 598	669, 049	668, 700
Rock-house discard do	128, 494	119, 867	154, 025	158, 438
Rock treated do	465, 100	440, 731	515, 024	510, 262
Cost of mining, transportation, stamping, and taxes per ton of rock	$2. 50	$2. 71	$2. 67	$2. 44
Refined copper produced pounds	11, 391, 338	10, 520, 771	10, 864, 085	10, 659, 413
Refined copper per ton of rock treated do	24. 49	23. 87	21. 09	20. 89

Production was not curtailed at the properties of the Copper Range Co. until November, 1930; consequently, the output for the year was only slightly less than in 1929. In 1930, 23,793,918 pounds were produced, compared with 24,197,316 pounds in 1929. Of the total output, according to the thirtieth annual report of the company, 13,799,988 pounds were produced for the Copper Range Co. in 1930 and 13,866,966 pounds in 1929, one-half of Champion's output belonging to St. Mary's Mineral Land Co. Owing to the high cost of production at the Trimountain mine and the low price for copper that prevailed during the year, operations were suspended in May. Costs of producing copper by the Copper Range Co. were lower in 1930 than in 1929; the price received was 6½ cents a pound less. The big improvement in costs at the Champion mine is shown more forcibly by the statement of costs by quarters as follows: First quarter, 14.5 cents a pound; second, 11.85 cents; third, 10.25 cents; and fourth, 10.10 cents. All of the stamping was done at the Champion mill. The new flotation installations for heads 4 and 3 were completed during the year. The lack of demand for copper in 1930 resulted in the accumulation of 5,202,000 pounds of copper by the end of the year and further accumulation in 1931. Dividends paid during the year totaled $493,444, compared with $789,510 paid in 1929.

Copper produced by the Champion Copper Co., 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net profits
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	531, 780	20, 719, 307	39. 018	9. 82	13. 329	$719, 955. 51
1922	503, 593	19, 583, 806	38. 964	9. 93	14. 359	890, 515. 16
1923	449, 130	18, 412, 630	41. 03	11. 14	14. 86	738, 871. 98
1924	457, 160	20, 061, 630	43. 88	10. 49	13. 76	709, 276. 53
1925	414, 645	17, 957, 605	43. 308	11. 73	14. 258	497, 764. 43
1926	454, 654	17, 658, 820	38. 84	10. 83	13. 948	597, 042. 27
1927	403, 260	16, 098, 926	39. 92	10. 84	13. 42	455, 791. 07
1928	427, 240	19, 563, 535	45. 79	11. 10	15. 01	829, 357. 45
1929	446, 804	20, 660, 701	46. 24	11. 76	17. 94	1, 267, 685. 97
1930	(2)	19, 999, 564	44. 57	11. 60	11. 43	[3] 32, 955. 04

[1] Excludes depreciation and depletion.
[2] Figures not given.
[3] Deficit.

Copper produced by the Baltic mine, 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net loss
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	195, 816	7, 608, 847	38. 86	14. 15	13. 078	$81, 668. 95
1922	165, 804	5, 329, 568	32. 14	16. 76	13. 958	149, 578. 09
1923	137, 801	4, 877, 248	35. 51	18. 42	14. 626	189, 880. 94
1924	150, 101	4, 769, 286	31. 77	15. 95	13. 76	104, 574. 24
1925	140, 958	4, 255, 069	30. 18	17. 74	14. 25	148, 517. 14
1926	126, 157	3, 690, 041	29. 25	18. 28	13. 94	160, 073. 52
1927	121, 504	4, 207, 819	34. 63	13. 50	13. 42	3, 120. 98
1928	92, 742	3, 415, 082	36. 82	14. 54	15. 01	[2] 16, 085. 53
1929	53, 833	2, 127, 926	39. 53	21. 27	17. 94	62, 339. 97
1930	(3)	3, 251, 705	49. 72	11. 82	11. 43	(3)

[1] Excludes depreciation and depletion. [2] Net profit. [3] Figures not given.

Copper produced by the Trimountain mine, 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net loss
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	143, 172	4, 341, 584	30. 32	18. 27	13. 078	$183, 560. 50
1922	130, 913	4, 116, 100	31. 44	16. 46	13. 95	67, 576. 58
1923	6, 273	281, 482	44. 87	(2)	14. 62	140, 563. 74
1924	8, 159	278, 259	34. 10	(2)	13. 76	87, 053. 47
1925	35, 465	1, 065, 044	30. 03	(2)	14. 25	39, 302. 47
1926	63, 837	2, 177, 416	34. 11	13. 43	13. 94	[3] 11, 253. 16
1927	67, 281	2, 354, 808	35. 00	12. 25	13. 42	[3] 27, 476. 86
1928	38, 950	1, 275, 515	32. 74	16. 90	15. 01	24, 100. 34
1929	42, 763	1, 408, 689	32. 94	22. 92	17. 94	57, 968. 20
1930	(2)	542, 649	37. 81	16. 38	11. 43	(2)

[1] Excludes depreciation and depletion. [2] Figures not given. [3] Net profit.

The Mohawk Mining Co. hoisted 484,910 tons of rock in 1930 and stamped 472,623 tons, which yielded 18,778,400 pounds of mineral. Only 3,582,500 pounds of mineral were smelted, yielding 2,706,762 pounds of refined copper; the remainder was held in storage. The company estimated that the mineral on hand contained 10,600,000 pounds of copper. In 1929 the company hoisted 637,156 tons of rock and stamped 619,585 tons, from which 27,865,390 pounds of mineral, yielding 20,043,127 pounds of refined copper, were produced. The mill was in operation 61 per cent of its possible stamping time. The company reports that with the exception of No. 2 stamp, which is not needed now, the entire mill plant of three heads and flotation equipment, equivalent to four heads, is in first-class condition. Approximately 55 per cent of the total rock stamped is treated by flotation. Dividends totaling $459,937.50 were paid during 1930, compared with $920,000 in 1929.

Copper produced by the Mohawk Mining Co. in 1930

Rock hoisted	short tons	484, 910
Rock stamped	do	472, 623
Product of mineral	pounds	18, 778, 400
Mineral smelted	do	3, 582, 500
Refined copper produced	do	2, 706, 762
Yield per ton of rock treated [5]	do	28. 155
Estimated copper in mineral on hand	do	10, 600, 000
Cost per ton of rock hoisted [5]		$1. 900
Cost per ton of rock stamped [5]		$1. 949
Operating cost per pound of refined copper [5]	cents	6. 924
Cost of taxes [5]	do	. 442
Cost of smelting, freight, and marketing product, including eastern offices' expenses [5]	cents	1. 358
		8. 724

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[5] Estimated because of storage of mineral.

The Quincy Mining Co. produced 18,042,927 pounds of mineral in 1930, which yielded 10,939,787 pounds of refined copper, compared with 7,088,500 pounds of mineral and 4,459,426 pounds of copper in 1929. Production at the Quincy mine has been curtailed for several years, due largely to a run of bad luck which included a fire in the No. 2 shaft in 1927; the mine had to be closed and all connections with the surface sealed in order to smother the fire. Operations in 1928 and 1929 were confined chiefly to shaft sinking, drifting, recovery of No. 2 shaft, and extending the openings to the mine for the retreating stope method of mining on a large scale. The large increase in output in 1930, therefore, indicates only the approach to a return to normal operations. The low price for copper brought about a curtailment in operations in July, when the labor forces in each department were reduced and the mine was put on a 5-day-week basis. In October a further curtailment in labor forces was made. The average recovery of copper for the year was 24.27 pounds to the ton, and the average recovery of copper from ore produced during the latter part of the year was 27.58 pounds to the ton. At the stamp mill 1 Dorr classifier (3 by 18 feet) and 7 rubber-top roughing tables were installed at No. 1 head to replace 6 Tamarack separators, 24 roughing jigs (2-compartment), and 4 finishing jigs (3-compartment). The operation of this new equipment, according to the company, reduces the labor factor, increases the tenor of mineral sent to the smelter, and reduces copper losses in tailings or waste sands. At No. 2 head complete flotation equipment was installed, making four flotation units in No. 1 mill with one flotation unit yet to be installed. The smelter, operating at reduced capacity, made the lowest costs in its history.

Copper produced by the Quincy Mining Co., 1924–1930

Year	Copper rock and mass	Mineral	Copper	Yield of copper per ton of rock
	Short tons	*Pounds*	*Pounds*	*Pounds*
1924	588,100	24,489,920	14,838,633	25.24
1925	586,913	22,721,380	14,357,523	24.46
1926	517,900	20,220,795	13,290,052	25.66
1927	413,000	15,336,690	9,718,662	23.53
1928	60,834	1,891,200	1,220,336	20.06
1929	207,833	7,088,500	4,459,426	21.46
1930	[1] 450,800	18,042,927	10,939,787	24.27

[1] Not given in company report but indicated by other figures.

MISSOURI

By J. P. Dunlop

The value of the mine production of silver, copper, lead, and zinc in Missouri in 1930 was $21,089,545, compared with $26,558,545 in 1929. The value of the silver decreased $31,282, that of zinc $416,388, and that of lead $5,043,894; the value of the copper increased $22,564. The mine production of lead in Missouri in 1930 was equivalent to 35 per cent of the smelter production of primary lead from domestic sources in the United States, compared with 29.5 per cent in 1929; the mine production of zinc in Missouri was 2.2 per cent of the total primary zinc produced by domestic smelters and electrolytic plants from domestic ores in 1930, compared with 1.8 per cent in 1929 and

22.7 per cent in 1917. About 40 mines and prospects in Missouri shipped lead or zinc concentrates in 1930.

Mine production of copper and silver in Missouri, 1921–1930

Year	Copper		Silver		Year	Copper		Silver	
	Pounds	Value	Fine ounces	Value		Pounds	Value	Fine ounces	Value
1921	137, 591	$17, 749	69, 902	$69, 902	1926	1, 077, 000	$150, 780	90, 000	$56, 160
1922	797, 400	107, 649	212, 656	212, 656	1927	451, 000	59, 081	233, 931	132, 638
1923	202, 556	29, 776	177, 270	145, 361	1928	65, 000	9, 360	176, 840	103, 451
1924	182, 811	23, 948	103, 694	69, 475	1929	2, 240	394	181, 638	96, 813
1925	12, 100	1, 718	83, 340	57, 838	1930	176, 600	22, 958	170, 210	65, 531

The silver content of the lead ores is so small that it is disregarded in the assay and sale of the concentrates. For this reason the smelter reports must be relied on for the silver production. The quantity of silver produced in any year bears no direct ratio to the quantity of lead concentrates smelted during that year, because the silver content is so small that the silver bullion is stored and refined in batches. Over a series of years the concentrates average about 1 ounce of silver to the ton.

All of the copper produced in 1930 was derived from matte recovered in smelting lead ores; no copper ore was shipped in 1930.

The value of the lead and zinc from concentrates produced in Missouri in 1930 was $21,001,056, a decrease of $6,460,282 from the value in 1929.

The production of lead concentrates (of which only 207 tons were lead carbonate) was 278,919 tons, compared with 279,403 tons in 1929. Of the total output in 1930, 277,520 tons were derived from southeastern Missouri, a decrease of 466 tons. The average lead content of the galena concentrates from this district was 73 per cent in 1930, compared with 72.7 per cent in 1929. The lead derived from galena concentrates in southeastern Missouri in 1930 was 198,622 tons, an increase of 1,187 tons. Shipments of galena concentrates from southwestern Missouri in 1930 were 1,192 tons compared with 1,263 tons in 1929. Shipments of lead carbonate were 207 tons, an increase of 53 tons. The quantity of lead recovered from concentrates shipped from southwestern Missouri was 1,010 tons, a decrease of 24 tons. The average lead content of the galena from southwestern Missouri in 1930 was 76 per cent, and the average value of the galena concentrates was $59.39 per ton or $22.92 less than in 1929.

The total quantity of sphalerite concentrates from Missouri mines in 1930 was 19,583 tons, a decrease of 756 tons compared with 1929; 11,172 tons of the total came from southwestern Missouri. The concentrates sold at an average price of $33.55 a ton and had an average zinc content of 60 per cent, compared with an average price of $40.53 and an average assay of 60.3 per cent in 1929. The shipments of sphalerite concentrates from southeastern Missouri were 8,411 tons of 58.2 per cent zinc content.

The shipments of zinc carbonate and silicate in 1930, which came entirely from southwestern Missouri, amounted to 1,696 tons, or 344 tons more than in 1929. The average zinc content of these concentrates was 40.1 per cent and the average value per ton was $24 compared with 40.2 per cent and $21.24 in 1929.

The value of the galena concentrates from southeastern Missouri (which produced 99 per cent of the total for the State) was $16,558,-

920, or $4,458,390 less than in 1929; the value of the sphalerite concentrates was $158,116, or $119,216 less than in 1929. The total value of the lead and zinc concentrates from southwestern Missouri declined from $681,167 in 1929 to $497,339 in 1930.

The total quantity of crude ore and old tailings treated in Missouri in 1930 was 7,010,100 tons. The total amount received for all classes of zinc and lead concentrates sold in 1930 was $17,214,375, an average of $2.46 to the ton of crude ore and old tailings treated, or 74 cents less than in 1929.

In the following tables, showing the tenor of ore ("dirt") and concentrates from Missouri, it has been considered advisable to segregate ores of different nature. The disseminated lead ore of southeastern Missouri differs radically from the lead and zinc ores of the so-called "soft-ground" deposits of southwestern Missouri. Each class of ore has its peculiar problems of mining and ore dressing. The data are given for the ores mined in the Joplin region, but there have been no recoveries from "sheet ground" since 1921. In general, the tables reflect very closely the conditions of the industry.

Mine production of lead and zinc in Missouri in 1930 by districts

District	Lead concentrates				Zinc concentrates			
	Galena		Carbonate		Sphalerite		Silicate and carbonate	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Aurora	27	$1,751			35	$1,010	1,475	$37,017
Duenweg-Porto Rico	50	3,500	50	$3,000				
Granby	81	4,206					208	3,435
Joplin	253	13,692	107	5,356	3,054	109,937		
Oronogo	133	7,393					6	86
Spring City-Spurgeon-Seneca	83	4,896	50	2,700			7	160
Waco	72	3,308			8,004	262,152		
Webb City-Carterville-Prosperity	493	32,046			79	1,694		
	1,192	70,792	207	11,056	11,172	374,793	1,696	40,698
Southeastern Missouri	277,520	16,558,920			8,411	158,116		
	278,712	16,629,712	207	11,056	19,583	532,909	1,696	40,698
Total, 1929	279,249	21,121,003	154	9,450	20,339	816,646	1,352	28,710

District	Metal content [1]			
	Lead		Zinc	
	Short tons	Value	Short tons	Value
Aurora	21	$2,100	523	$50,208
Duenweg-Porto Rico	66	6,600		
Granby	86	8,600	71	6,816
Joplin	248	24,800	1,659	159,264
Oronogo	85	8,500	2	192
Spring City-Spurgeon-Seneca	81	8,100	3	288
Waco	40	4,000	4,207	403,872
Webb City-Carterville-Prosperity	383	38,300	39	3,744
	1,010	101,000	6,504	624,384
Southeastern Missouri	198,622	19,862,200	4,307	413,472
	199,632	19,963,200	10,811	1,037,856
Total, 1929	198,469	25,007,094	11,017	1,454,244

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in southwestern Missouri, 1927–1930

	1927	1928	1929	1930
Total ore short tons	513, 800	281, 300	428, 400	328, 800
Total concentrates in ore:				
Lead per cent	0. 66	0. 56	0. 33	0. 40
Zinc do	5. 57	5. 47	3. 80	3. 89
Metal content of ore:				
Lead do	. 50	. 41	. 25	. 31
Zinc do	3. 21	3. 23	2. 26	2. 25
Average lead content of galena concentrates do	76. 5	74. 2	76. 3	76. 0
Average lead content of lead carbonate concentrates do	60. 0	59. 1	60. 0	60. 0
Average zinc content of sphalerite concentrates do	58. 3	59. 9	60. 3	60. 0
Average zinc content of silicates and carbonates do	38. 2	39. 5	40. 2	40. 1
Average value per ton:				
Galena concentrates	$83. 26	$75. 16	$82. 31	$59. 39
Lead carbonate concentrates	$60. 00	$60. 00	$61. 36	$53. 42
Sphalerite concentrates	$40. 08	$38. 38	$40. 53	$33. 55
Zinc silicates and carbonates	$26. 26	$20. 97	$21. 24	$24. 00

Tenor of lead ore and concentrates in southeastern Missouri disseminated-lead district, 1927–1930

	1927	1928	1929	1930
Total lead ore short tons	6, 310, 200	6, 292, 500	6, 439, 600	6, 681, 300
Galena concentrates in ore per cent	4. 42	4. 37	4. 31	4. 15
Lead content of ore do	3. 17	3. 17	[1] . 11	[1] . 13
Average lead content of galena concentrates do	71. 7	72. 1	72. 7	73. 0
Average value per ton of galena concentrates	$83. 62	$69. 50	$75. 61	$59. 60
Average zinc content of sphalerite concentrates per cent			58. 1	58. 2
Average value per ton of sphalerite concentrates			$39. 44	$18. 80

[1] Zinc content.

Mineral Resources for 1914, Part I, pages 72 to 77 and 97 to 100, gave a brief history of lead and zinc mining in the southeastern Missouri and Joplin regions, as well as data relating to the total lead and zinc production, the mining and milling practice, the character of the ore and concentrates, and the methods of selling them.

Data from 20 mines using open-stope methods in the Eastern and Central States are given in a recent publication [6] of the Bureau of Mines. Nearly all the lead and zinc ore obtained in the Central States is mined by this method.

SOUTHWESTERN MISSOURI

Area and production.—The southwestern Missouri lead and zinc areas include the largest part of the Joplin region, the remainder lying in southeastern Kansas and northeastern Oklahoma.

Lead and zinc concentrates produced in the Missouri part of the Joplin region, 1907–1930

	Short tons	Value	
		Total	Average
Lead concentrates	463, 532	$29, 997, 326	$64. 71
Sphalerite concentrates	2, 939, 394	148, 806, 022	50. 62
Zinc carbonate and silicate concentrates	307, 838	9, 485, 696	30. 81
	3, 710, 764	188, 289, 044	

Prices.—The following quoted base prices apply not only to southwestern Missouri but also to all the mines in Oklahoma and Kansas that are in the Joplin or tri-State region, except that small scattered lots of concentrates of less than a carload bring slightly lower prices. They do not apply to concentrates shipped from southeastern Missouri. The demand for high-grade sphalerite containing less than 0.20 per cent of lead decreased in 1930, and frequently it was impossible to obtain the customary $1 premium paid for this class of concentrates. The old mixed lots of flotation and coarse concentrates were cleaned up from mine bins, and the $2 differential charged on flotation concentrates was in force only during January, 1930; thereafter only $1 a ton was deducted from quoted prices for flotation zinc concentrates. There was a more active demand for the flotation sphalerite than for the jig and table product; apparently the retort smelters, which are nearly all equipped to handle flotation products, found it profitable to purchase the flotation concentrates at the lower price. Some of the sphalerite containing considerable galena was also easily marketed; it was purchased by smelters that run such leady ores over tables at the smelter. This enables the smelter to recover galena, which costs nothing but the expense of tabling.

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[6] Jackson, C. F., Mining Ore in Open Stopes, Central and Eastern United States: Inf. Circ. 6193, Bureau of Mines, November, 1929, 30 pp.

The base price for sphalerite concentrates ranged from $37 to $26 during 1930. It was stable at $26 a ton from the end of October to the last week in December.

No base prices were quoted for zinc silicate in 1930 as the output was scattered and small. The milled zinc carbonate or silicate in car lots was in demand, but buyers did not desire small hand-cobbed lots.

In 1930 the prices quoted for galena containing 80 per cent of lead showed the large variation of $17.50 a ton. The quoted price opened in January at $75 a ton (the highest quoted price in 1930) and closed in December at $57.50 (the lowest quoted price). The following table gives the prices at which galena concentrates (80 per cent lead) and sphalerite concentrates (60 per cent zinc), both coarse and flotation products, were quoted in 1930, by weeks.

Prices per short ton of galena concentrates and sphalerite concentrates in 1930 [1]

Week ended—	Galena (80 per cent) concentrates	Sphalerite (60 per cent) concentrates		Week ended—	Galena (80 per cent) concentrates	Sphalerite (60 per cent) concentrates	
		Jig and table	Flotation			Jig and table	Flotation
Jan. 3	$75.00	$35.00	$33.00	July 3	$60.00	$29.00	$28.00
10	75.00	35.00	33.00	11	60.00	29.00	28.00
17	75.00	35.00	33.50	18	60.00	30.00	29.00
24	75.00	35.00	33.50	25	60.00	33.50	31.00
31	75.00	37.00	35.00	Aug. 1	65.00	32.00	31.00
Feb. 7	75.00	35.00	33.50	8	65.00	32.00	31.00
14	75.00	37.00	36.00	15	65.00	32.00	31.00
21	75.00	37.00	36.00	22	65.00	31.00	30.00
28	75.00	37.00	36.00	29	65.00	31.00	30.00
Mar. 7	65.00	37.00	36.00	Sept. 5	65.00	31.00	30.00
14	62.50	37.00	36.00	12	65.00	32.00	31.00
21	62.50	37.00	36.00	19	65.00	30.00	29.00
28	67.50	37.00	36.00	26	65.00	30.00	29.00
Apr. 4	65.00	35.00	34.00	Oct. 3	62.50	30.00	29.00
11	62.50	35.00	34.00	10	60.00	29.00	28.00
18	62.50	35.00	34.00	17	57.50	27.00	26.00
25	62.50	35.00	34.00	24	57.50	26.00	25.00
May 2	62.50	35.00	34.00	31	57.50	26.00	25.00
9	62.50	33.00	32.00	Nov. 7	57.50	26.00	25.00
16	65.00	33.00	32.00	14	57.50	26.00	25.00
23	62.50	31.00	30.00	21	57.50	26.00	25.00
30	65.00	31.00	30.00	28	57.50	26.00	25.00
June 6	65.00	31.00	30.00	Dec. 5	57.50	26.00	25.00
13	65.00	31.00	30.00	12	57.50	26.00	25.00
20	62.50	29.00	28.00	19	57.50	26.00	25.00
27	60.00	29.00	28.00	26	57.50	26.00	25.00

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[1] Joplin Globe, Feb. 8, 1931, p. 14.

Average prices per ton paid for sphalerite and zinc and lead concentrates in southwestern Missouri, 1922–1930

	1922	1923	1924	1925	1926	1927	1928	1929	1930
Sphalerite	$31.91	$40.52	$41.91	$54.18	$49.01	$40.08	$38.38	$40.53	$33.55
Zinc silicate or carbonate concentrates	21.25	26.57	24.29	30.80	31.61	26.26	20.97	21.24	24.00
Galena concentrates	69.44	83.40	101.31	110.51	105.74	83.26	75.16	82.31	59.39

General conditions.—Only eight mills were operated in southwestern Missouri in 1930, and none was operated continuously. Gougers and small lessees became more numerous toward the end of 1930, but drilling was inactive except on leases near Diamond and Stotts City. At many camps all the mines were idle and work at the Granby, Oronogo, Spurgeon, and Spring City camps was confined to scrapping. The outlook for 1931 is poor, with indications for a large decrease in the shipments of sphalerite.

The Missouri part of the Waco district with only two producing properties shipped 72 per cent of the sphalerite. The Missouri-Kansas Zinc Corporation treated ore from upper levels and reran a large quantity of old tailings. The Gascho Mining Co. milled crude ore at its 300-ton mill.

The output from near Smithfield was less than in 1929. The Isherwood mine, which was a large producer of high-grade sphalerite, has been closed. The operations of the Midwood mine were suspended after some small shipments were made. The Superior Lead & Zinc Co.'s 150-ton mill on the Rex land near Joplin was operated part of 1930 on ore mined on the 100-foot level. The Eldorado Mining Co. at Aurora was the largest producer of zinc silicate, mainly from ore milled for lessees. Other shippers at Aurora were the Aurora, Bull Frog, and Rolla mines.

Churn drilling at the old camp at Stotts City, which has been idle many years, disclosed a new run of ore which was opened by the Shirley D. Mining Co. A shaft was sunk to the 160-foot level, and a 150-ton mill was erected but not run in 1930. At Diamond considerable drilling was done, and a shaft was sunk on the Greniger land by the Easy Money Mining Co.

CENTRAL AND SOUTHEASTERN MISSOURI

A brief description of the ore deposits in central and southeastern Missouri is given in the chapter of this series for 1915.

Copper, silver, nickel, and cobalt occur in the ore in considerable quantity near Fredericktown and in small quantity irregularly in nearly all the deep mines of this region. It is only near Fredericktown that the copper, nickel, and cobalt content of the ore has been the object of mining, yet a concentrate of these metals has been recovered as a table middling at several plants in other parts of the district.

In the disseminated-ore district the production increased rapidly after 1869 and is estimated by Buckley to have amounted to 1,202,607 tons of lead concentrates, valued at $59,869,354, for the period 1869 to 1906, inclusive. The mine production of southeastern and central Missouri has been reported annually since 1907.

The output of silver in Missouri in 1930 was derived from refining pig lead or from copper matte or zinc concentrates recovered in milling or smelting lead ores.

Mine production of lead and zinc concentrates in southeastern and central Missouri, 1907–1930

Year	Lead concentrates (galena)		Zinc concentrates			
			Sphalerite		Carbonate and silicate	
	Short tons	Value	Short tons	Value	Short tons	Value
1907–1920	3,302,935	$187,897,133	1,016	$44,137	10,285	$233,534
1921	280,358	11,737,400				
1922	271,294	14,779,869				
1923	259,320	19,434,633				
1924	292,604	24,739,819				
1925	314,403	31,727,170				
1926	300,480	28,239,733	2,301	101,243		
1927	279,441	23,360,294	8,390	289,816		
1928	274,925	19,107,891	6,597	236,111		
1929	277,986	21,017,310	7,031	277,332		
1930	277,520	16,558,920	8,411	158,116		

The lead ore mined in the disseminated-lead district in 1930, amounting to 6,681,300 tons, yielded 4.15 per cent of galena concentrates, which averaged 73 per cent of lead. The average value per ton of lead concentrates was $59.60, compared with $75.61 in 1929; the output of galena concentrates was about 277,520 tons, compared with 277,850 tons in 1929. As the two largest producers not only mine but also smelt their lead concentrates, the values given for concentrates are to a certain extent arbitrary. The galena concentrates produced in the southwestern Missouri region, which usually contain a higher lead content, are sold mainly on bids from purchasers, and the values for those concentrates are not comparable with values given for concentrates of the disseminated-lead district.

Analyses of ores mined in the disseminated-lead district in southeastern Missouri and of the various grades of resulting concentrates are given in Mineral Resources for 1919 and 1920.

No shipments of zinc carbonate from southeastern Missouri were reported in 1930, and the only sphalerite shipped was that from the flotation plants of the St. Joseph Lead Co. The average zinc content of the sphalerite concentrates shipped in 1930 was 58.2 per cent, and the average silver content was 18 to 20 ounces to the ton.

Only 162 tons of galena concentrates were shipped in 1930 by operators of shallow diggings. Most of the total was shipped to smelters by T. F. Blount, of Potosi; the rest was produced by the Annapolis Lead Co., the National Lead Co. (St. Louis), and the St. Joseph Lead Co. The Conqueror Lead Co.'s plant was abandoned in 1930.

The small output of copper was derived from the treatment of copper-lead matte at a western smelter; no copper ore was shipped in 1930.

The Annapolis Lead Co., in Iron County, worked its mine and 1,000-ton mill steadily (24 hours) in 1930. A good output was made from ore extracted from the 500-foot level.

The St. Joseph Lead Co. treated 5,428,000 tons of ore, which yielded more than 4 per cent of galena concentrates and some sphalerite concentrates. The company operated six mills, all equipped for flotation.

The National Lead Co. (St. Louis Smelting & Refining Co.) operated five shafts (average depth, 525 feet) and a 3,500-ton mill equipped for flotation.

About 42 per cent of the galena and all the sphalerite from southeastern Missouri were recovered by flotation. The methods of mining disseminated lead ore at a mine in southeastern Missouri are described in a publication [7] issued by the Bureau of Mines in September, 1929.

OKLAHOMA

By J. P. Dunlop

Mine shipments of lead and zinc in Oklahoma in 1930, by districts

District	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Miami	30,458	$1,970,865	255,376	$7,670,523	22,928	$2,292,800	132,135	$12,684,960
Quapaw and Sunnyside	168	10,057	7,793	249,001	124	12,400	4,018	385,728
	30,626	1,980,922	263,169	7,919,524	23,052	2,305,200	136,153	13,070,688
Total, 1929	61,041	5,103,629	374,077	14,426,962	46,513	5,860,638	192,042	25,349,544

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses o both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1929 and 1930

	1929		1930	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled ..... short tons	6,408,400	2,916,200	4,118,600	3,095,000
Total concentrates recovered:				
Galena ..... do	50,666	375	38,054	946
Sphalerite ..... do	340,380	45,697	215,821	52,350
Ratio of concentrates to ore, etc.:				
Lead ..... per cent	0.78	0.01	0.92	0.03
Zinc ..... do	5.31	1.52	5.23	1.70
Metal content of ore, etc.:				
Lead ..... do	.62	.01	.71	.02
Zinc ..... do	3.11	.85	3.08	.99
Average lead content of galena concentrates ..... do	77.8	65.3	77.2	63.9
Average zinc content of sphalerite concentrates ..... do	58.6	56.3	58.9	58.4
Average value per ton:				
Galena concentrates	$83.72	$66.45	$65.17	$49.22
Sphalerite concentrates	$39.02	$35.34	$30.91	$28.49

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[7] Jackson, C. F., Methods of Mining Disseminated Lead Ore at a Mine in the Southeast Missouri District: Inf. Circ. 6170, Bureau of Mines, September, 1929, 21 pp.

The following table gives the output of lead and zinc ore, old tailings, etc., for Oklahoma from 1927 to 1930.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1927–1930

		1927	1928	1929	1930
Total ore, old tailings, and slimes milled in Oklahoma	short tons	9,932,400	8,028,000	9,324,600	7,213,600
Total concentrates in ore, etc.:					
Lead	per cent	0.68	0.61	0.55	0.54
Zinc	do	4.07	4.30	4.14	3.72
Metal content of ore, etc.:					
Lead	do	.53	.48	.42	.42
Zinc	do	2.36	2.49	2.42	2.19
Average lead content of galena concentrates	do	78.2	78.4	77.8	76.8
Average zinc content of sphalerite concentrates	do	58.1	57.8	58.3	58.8
Average value per ton:					
Galena concentrates		$86.77	$80.79	$83.61	$64.68
Sphalerite concentrates		$38.29	$36.30	$38.57	$29.00

Mine production of lead and zinc concentrates in Oklahoma, 1891–1930, by districts

District	Lead concentrates (mainly galena)		Zinc concentrates			
			Sphalerite		Zinc silicate and carbonate	
	Short tons	Value	Short tons	Value	Short tons	Value
Davis			558	$27,399	899	$24,592
Miami	1,007,785	$89,183,512	5,274,225	221,350,717		
Peoria	2,206	109,163	220	8,289	2,944	76,787
Quapaw and Sunnyside	24,371	2,209,912	209,358	8,826,220	164	2,692
	1,034,362	91,502,587	5,484,361	230,212,625	4,007	104,071

Mineral Resources for 1914 contains a brief history of mining in the districts in Oklahoma, also the estimated total production of each district by years.

The lead and zinc deposits of northeastern Oklahoma, so far as known, are confined to Ottawa County and form the southwestern extension of the deposits in the Joplin region. There are three camps—Peoria, Quapaw-Sunnyside, and Miami—in which extensive mining has been done, and a fourth, the Sycamore Creek district, along the Seneca fault block, 2 to 3 miles southwest of Seneca, Mo., in which considerable prospecting has been done and some ore mined. The lead and zinc deposits in southern Oklahoma are near Ravia, at the southeast end of the Arbuckle Mountains, and near Davis, Murray County, at the northwest end of the same range.

The geology and occurrence of ore and the methods and costs of mining in the tri-State or Joplin region in Oklahoma are presented in a publication[8] issued by the Bureau of Mines in May, 1929.

The quantity of ore, old tailings, and slimes milled in Oklahoma decreased 2,111,000 tons in 1930. The quantity milled at mines near Quapaw and Sunnyside was about 3 per cent of the total, compared with 6 per cent in 1929.

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[8] Netzeband, W. F., Method and Cost of Mining Zinc and Lead at Mine No. 2, Tri-State District, Picher, Okla.: Inf. Circ. 6121, Bureau of Mines, May, 1929, 11 pp.

The quantity of old tailings and slimes treated increased from 2,916,200 tons in 1929 to 3,095,000 tons in 1930, and the percentage of recovery of sphalerite increased. The average assay of the sphalerite from tailings increased from 56.3 per cent in 1929 to 58.4 per cent in 1930.

The quantity of ore, old tailings, and slimes milled in Oklahoma decreased from 9,324,600 tons in 1929 to 7,213,600 tons in 1930. The average zinc content of the sphalerite was 58.8 per cent in 1930, and separate assays ranged from 40 to 62 per cent. An assay of a composite sample of 4,200 lots of concentrates shipped from the Joplin region in 1930 made by Waring & Williams showed an average content of 58.8 per cent of zinc, 1.4 per cent of iron, 0.45 per cent of lead, and 0.42 per cent of cadmium. The average cadmium content increased in 1930, and the average lead and iron contents were considerably less than in 1929. The average zinc assay, as computed from the reports of all companies selling sphalerite, was about 59 per cent. An average of about 1 ton of galena to 7 tons of sphalerite was recovered in concentrates from Oklahoma mines in 1930, although the shipments of concentrates do not indicate this fact.

The total quantity of lead and zinc concentrates shipped from Oklahoma in 1930 was 32 per cent less than in 1929, and the total value was a little more than half that in 1929.

Oklahoma produced 63 per cent of the total output of both zinc and lead concentrates from the Joplin region in 1930, although the Oklahoma shipments of sphalerite decreased 110,908 tons.

The value of the lead and zinc recovered from concentrates shipped from mines in Oklahoma in 1930 was $15,375,888, compared with $31,210,182 in 1929. The lead from concentrates sold decreased from 46,513 to 23,052 tons, and the zinc from sphalerite sold decreased from 192,042 to 136,153 tons.

The average lead content of the galena concentrates shipped was 77.8 per cent in 1929 and 76.8 per cent in 1930. The average zinc content of the sphalerite concentrates shipped was 58.3 per cent in 1929 and 58.8 per cent in 1930.

In 1930 about 83 mills in the Oklahoma part of the Joplin or tri-State region shipped 30,626 tons of galena concentrates and 263,169 tons of sphalerite concentrates. The average value of the galena concentrates decreased $18.93 a ton, and the average value of the sphalerite concentrates decreased $8.48 a ton. The stocks of sphalerite in mine bins were about the same at the end of 1930 as at the end of 1929.

All the large mills and nearly all the small mills are equipped with flotation units, and the output from this source in 1930 in Oklahoma was 3,686 tons of galena concentrates and 82,390 tons of sphalerite concentrates. About 12 per cent of the output of galena and 31 per cent of the sphalerite were flotation products.

Most of the tailings treated by flotation yield little or no galena, regardless of the original content of the crude ore, and the galena recovered is usually low in lead. The galena from this source averaged 63.9 per cent lead in 1930 and sold for an average price of $49.22 a ton. The success of the Bird Dog mill in sampling and milling ore from different leaseholds will probably result in the erection of large mills by several operators and the abandonment of the practice of equipping each 40 or 80 acre lease with a separate mill.

A bulletin issued early in 1931 by the Tri-State Zinc and Lead Ore Producers Association states that the average cost per ton of rock of a large group of mines was reduced from $1.89 in January, 1930, to $1.33 in December, 1930, and that the average cost of producing a ton of lead and zinc concentrates was reduced from $39.98 to $29.64. This does not represent an actual saving of more than $10 a ton, as part of the decrease was due to the closing of mines which could not operate profitably on the low-grade crude ore mined.

The total quantity of ore and old tailings milled in the Miami part of the Joplin region in Oklahoma and Kansas in 1930 was 10,054,700 tons, and the shipments were 45,472 tons of galena concentrates and 394,459 tons of sphalerite concentrates. Of these concentrates, 4,819 tons of galena and 116,753 tons of sphalerite were flotation products. Each of 51 mines in this area shipped galena and sphalerite concentrates exceeding $100,000 in value. Notwithstanding the decreased output in 1930 more shafts were utilized and more mills were operated than in any other area in the United States. The zinc content of the flotation sphalerite concentrates increased notably and some ran more than 60 per cent zinc; most of the shipments assayed from 57 to 58 per cent. A history of the mining in the Miami district, including the output by years for 1908 to 1914 and the location of the mines and mills, was given in Mineral Resources for 1914. The reports for 1915 to 1929 contain full reviews of the production, new territory prospected, new mines opened, and new mills erected in those years. A brief description of the ore deposits in the Miami district is given in Mineral Resources for 1915.[9]

The total shipments from properties that may be classed as in the Cardin-Douthat area amounted to 13,265 tons of galena and 134,885 tons of sphalerite. A total of about 3,701,300 tons of ore and old tailings (2,062,000 tons of crude ore and 1,639,300 tons of old tailings) was treated, and the recovery in concentrates averaged about 0.51 per cent for galena and 3.66 per cent for sphalerite. The low recovery was due to the increased milling of old tailings. The ratio of galena to sphalerite recovered at all mines in the vicinity of Douthat was 1 ton of galena to 12 tons of sphalerite; in the Cardin section it was 1 ton of galena to about 6 tons of sphalerite. The old tailings in the Cardin-Douthat area yielded 595 tons of galena and 25,189 tons of sphalerite.

The territory east of Picher near the Hockerville and Zincville camps was less productive than in 1929, when the shipments from 12 mines and 3 tailings mills amounted to 6,053 tons of galena and 62,874 tons of sphalerite; in 1930 the shipments from 12 mines and 4 tailings mills amounted to 4,372 tons of galena and 44,581 tons of sphalerite from 658,000 tons of ore and 558,600 tons of old tailings and slimes treated.

The production of the mines near Picher also decreased. In 1929 the quantity of ore and old tailings milled was 3,010,700 tons and the shipments were 19,288 tons of galena and 92,249 tons of sphalerite. In 1930 the quantity of ore and old tailings milled was 2,045,400 tons, and the shipments were 12,738 tons of galena and 75,751 tons of sphalerite. The quantity of old tailings milled in 1930 was 816,500 tons compared with 1,106,500 tons in 1929. The average zinc content of the sphalerite was 58.4 per cent, and the lead content of the galena was 76.5 per cent.

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[9] Siebenthal, C. E., Zinc. Mineral Resources of the United States, 1915, Part I, pp. 888-890.

At Commerce (old Hattenville) only one mine was operated intermittently, and shipments of concentrates were small.

No concentrates were shipped in 1930 from the old Peoria camp, and very little development was done.

Near Cardin and Tar River.—This area in the Miami field had the largest shipments of concentrates in 1930. The leading shippers were the Adams Mining Co., O. M. Bilharz Mining Co., Commerce Mining & Royalty Co. (6 mills), Evans Wallower Lead Co. (2 mills), Interstate Zinc & Lead Co., Kansas Explorations (Inc.), and Rialto Mining Corporation. Other shippers were the American Zinc Co. of Oklahoma, Canam Metals Corporation, Davis Mining Co., Federal Mining & Smelting Co., L. & G. Mining Co., Mary M. Mining Co., Pioneer Lead & Zinc Co., and Velie Mine Corporation. Old tailings were treated at the Bilharz, Evans Wallower, Foch, Gosling, Pioneer, Rialto, Standard, and Velie mills.

The total quantity of old tailings and slimes treated in 1930 was 1,155,100 tons; the production from this source was 525 tons of galena, averaging 61 per cent of lead, and 17,094 tons of sphalerite, averaging 58.7 per cent of zinc. The quantity of old tailings treated in 1930 was 212,800 tons more than in 1929. The Canam Metals Corporation operated the Foch, Southside, and Tiger No. 2 mines for a small part of 1930. The Tiger No. 2 is now owned by the Mary M. Mining Co., and the Douthat mine is now worked by the Davis Mining Co. The L. & G. Mining Co. and the Tom L. Mining Co. are now in the hands of a receiver.

Near Century and Douthat.—About 76 per cent of the sphalerite concentrates shipped from properties in this area were sold by the Admiralty Zinc Co., the Consolidated Lead & Zinc Co., and the Skelton Lead & Zinc Co., and more than 91 per cent of the galena concentrates were shipped by the same three operators. The only other large producer from crude ore was the Ramage Mining Co. Tailings mills were operated by the California Milling Co., the Canam Metals Corporation, the Glendale Milling Co., the New Chicago Mines Corporation, the Skelton Lead & Zinc Co., and C. E. Theurer.

Near Hockerville and Zincville.—The Brewster mine of the Federal Mining & Smelting Co. was again the largest shipper in this area. The Canadian Mining & Milling Co. ranked second. Other shippers of concentrates in 1930 were the Aztec, Columbus, Dorothy Bill, Eleventh Hour, Good Luck, H. B. & K. Mining Co. (Duluth), Imbau, and Massell mines, and the Blue Bonnet, Kropp, Retriever, Royal, and Semple tailings mills. The Beck mill was not operated, but large shipments of stored sphalerite were made in 1930. The Aztec mine of Smith Davis & Co. was operated for a few months before being abandoned. The Kropp mill was run steadily on tailings, but sales of concentrates in 1930 were very small.

Near Picher.—The quantity of crude ore and old tailings milled in the Picher area was considerably less in 1930 than in 1929. The quantity of old tailings treated was 816,500 tons (a decrease of 190,000 tons from 1929), from which 351 tons of galena concentrates and 14,215 tons of sphalerite concentrates (58.6 per cent zinc) were recovered. Mills treating ore (1,228,900 tons) shipped 12,387 tons of galena concentrates and 61,536 tons of sphalerite concentrates.

The large shippers in 1930 were the American Zinc Co. of Oklahoma, Canam Metals Corporation (2 mills), Commerce Mining & Royalty Co. (2 mills), Consolidated Lead & Zinc Co. (2 mills), Cortez King Brand Mining Co., Eagle-Picher Lead Co. (2 mills), Howe Mining Co., Jeff City Mining Co., Oko Mine, and Tri State Zinc Co.

Old tailings were treated by C. D. & T. Milling Co., Canam Metals Corporation (Whitebird and Golden Hawk), De Mier-King Milling Co., Jeff City Mining Co., Just Right Milling Co., H. T. Myers Milling Co. (New York), New Chicago Mines Corporation, and Retriever Milling Co. The new 1,000-ton Bird Dog mill[10] of the Commerce Mining & Royalty Co. was run steadily on ore from several leases and made a large output of concentrates; part of this output was not sold in 1930. The sampling methods proved satisfactory, and the apportionment of the mill output was deemed equitable. The success of this mill will probably induce other companies operating various leases by means of mills on every 40 or 80 acre tract to build a large central plant to be run continuously instead of operating small mills 10 hours a day on each separate leasehold.

Near Quapaw and Sunnyside.—In this area 165,700 tons of crude ore and 80,600 tons of old tailings were milled in 1930, and the shipments were 168 tons of galena and 7,793 tons of sphalerite. Mines of the Century Zinc Co. yielded more than half the output; most of the remainder was the output of the John L. Mining Co., Tulsa Lead-Zinc Co., and White McKay Mining Co. The Buckeye, Davenport, Ilhawa, and Rainbow mines were idle all of 1930; the Diamond Joe was run spasmodically. The Star Mining Co. shipped a few tons of concentrates after building a 150-ton mill. The Bingham and Malsbury mines of the Century Zinc Co. were abandoned. The entire output of the Tulsa Lead-Zinc Co. was from tailings.

WISCONSIN

By J. P. Dunlop

Mine production of lead and zinc in Wisconsin in 1930, by districts

District	Lead concentrates		Zinc concentrates				Metal content [a]			
			Sphalerite		Silicate and carbonate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Benton-New Diggings	155	$10,075	1,186	$13,987			109	$10,900	292	$28,032
Cuba City and Dodgeville	146	10,091	1,037	7,266			111	11,100	170	16,320
Hazel Green	247	16,340	17,643	245,565			188	18,800	4,987	478,752
Linden and Platteville	183	10,292	2,592	80,377	30	$823	120	12,000	1,374	131,904
Shullsburg	1,402	83,127	29,036	322,206			1,009	100,900	5,735	550,560
	2,133	129,925	51,494	669,401	30	823	1,537	153,700	12,558	1,205,568
Total, 1929	2,170	170,588	69,729	1,205,047	161	3,970	1,536	193,536	16,986	2,242,152

[a] In calculating the metal content of the ores from assays allowance has been made for roasting and smelting losses of both lead and zinc. In comparing the values of ore and metals it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

[10] Isern, Elmer, Central Milling in the Tri-State District: Eng. and Min. Jour., Jan. 26, 1931, pp. 49-54.

Tenor of lead and zinc ore and concentrates produced in Wisconsin, 1927–1930

	1927	1928	1929	1930
Total ore short tons	1,480,800	733,500	607,100	486,400
Total concentrates in ore:				
Lead per cent	0.20	0.33	0.36	0.44
Zinc do	8.83	9.84	11.5	10.6
Metal content of ore:				
Lead do	.14	.23	.26	.32
Zinc do	2.79	3.26	3.53	3.34
Average lead content of galena concentrates do	72.4	71.7	72.2	73.5
Average zinc content of sphalerite concentrates do	31.6	33.1	30.6	31.6
Average zinc content of zinc carbonate concentrates do	32.7	34.0	41.6	43.0
Average value per ton:				
Galena concentrates	$81.46	$73.30	$76.61	$60.91
Sphalerite concentrates	$17.22	$17.37	$17.28	$13.00
Zinc carbonate concentrates	$17.85	$15.92	$24.60	$27.77

The lead and zinc mines of Wisconsin are in Grant, Iowa, and Lafayette Counties and contain the most valuable part of the ore deposits of the upper Mississippi Valley region, a historical review of which is given in the Illinois section of the report of this series in Mineral Resources for 1914. A detailed description of the Wisconsin lead and zinc districts and of the mines in each district to the year 1906 is given by Bain.[11] The development of the mines subsequent to Bain's report and the output of Wisconsin mines have been set forth in Mineral Resources since 1906.

Roasting and electromagnetic separation have been utilized in the district for many years to produce a marketable zinc product. Comparatively few of the concentrating plants are equipped with roasters, but the larger mining interests own or control separating plants [12] and nearly all of the raw concentrates were roasted.

The only roasting and separating plant operated in Wisconsin in 1930 was the National Zinc Separating Co. at Cuba City. The Mineral Point Zinc Co.'s plant at Mineral Point has been dismantled. The shipments of concentrates came from about 18 mines, many of which were small. Old tailings re-treated in 1930 amounted to only a few thousand tons. The total material milled decreased 120,700 tons.

The total value of the mine output of lead and zinc in Wisconsin in 1930 was $1,359,268, compared with $2,435,688 in 1929. The quantity of galena concentrates sold decreased from 2,170 tons in 1929 to 2,133 tons in 1930, and the quantity of sphalerite concentrates decreased from 69,729 to 51,494 tons. The quantity of lead from galena concentrates was 1 ton more in 1930 than in 1929, and the quantity of zinc from all concentrates decreased 4,428 tons.

The Vinegar Hill Zinc Co. produced about 55 per cent of the galena and 83 per cent of the sphalerite although about seven mills were operated by other companies. Very little drilling or development work was done in 1930. The metal content of the raw sphalerite shipped in 1930 ranged from 22 to 60 per cent zinc content. Thirty-five per cent of the sphalerite ranged from 30 to 38 per cent zinc content, and 53 per cent of the total shipments averaged less than 30 per cent.

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[11] Bain, H. F., Zinc and Lead Deposits of the Upper Mississippi Valley: U. S. Geol. Survey Bull. 294, 1906, pp. 81–148.

[12] Deutman, E. G., The Roasting and Magnetic Separation of Wisconsin Zinc Ores: Eng. and Min. Jour., June 28, 1919, pp. 1107–1111.

The shipments of raw sphalerite decreased 18,235 tons; the zinc content was 1 per cent more than in 1929. Of the total shipments in 1930, less than 3,000 tons went direct to retort zinc smelters; the remainder went to the National Zinc Co.'s plant at Cuba City. The small zinc carbonate shipments were purchased by the Mineral Point Zinc Co. at Mineral Point.

The total shipments in 1930 from mines in the upper Mississippi Valley region (northern Illinois and Wisconsin) amounted to 51,524 tons of sphalerite, 30 tons of zinc carbonate, and 2,133 tons of galena. The average zinc content of the raw sphalerite concentrates from Wisconsin in 1930 was 31.6 per cent, and the average value per ton was $13, compared with 30.6 per cent and $17.28 in 1929. Mines in the Shullsburg district produced 66 per cent of the galena and 56 per cent of the sphalerite in 1930.

The Vinegar Hill Zinc Co. operated the Badger mine and 500-ton mill at Hazel Green and the James and Mullen mines at Shullsburg, also equipped with 500-ton mills. Other large shippers of concentrates in 1930 were the Badger Zinc Co. at Linden, George Baker (Longhorn mine at Benton), the Lawyer tailing mill, the Lucky Five Mining Co. at Dodgeville, and the Middie Mining Co. at Shullsburg. Small shippers in 1930 included the Paris Hill Mining Co. and Edward Dare of Benton.

The Badger Zinc Co. completed a 250-ton concentration flotation mill, the first in the Wisconsin field, which had a good output of 60 per cent sphalerite concentrates and some galena concentrates having a lead content of 78 per cent.

No zinc carbonate was shipped from Highland; the small output was mainly that of Smith & Stephens of Linden.

Shipments of concentrates from Platteville were small. The Blockhouse mill was idle all the year. The mill formerly on the Roselip lease was moved to the Reilly land, and a 178-foot shaft was sunk.

The separating and roasting plant of the Mineral Point Zinc Co. at Platteville was dismantled.

C. J. Rodham did development work on the Pacquette lease at Shullsburg and sank a new shaft. A 350-ton flotation plant was under construction; the only shipments made in 1930 were of galena recovered during development.

The American Mining Co. operated the Mullen mine and mill at Shullsburg after June, 1930.

The Middie Mining Co. surrendered its lease on the Longhorn mine at Shullsburg in July, 1930, and J. F. Meloy mined the property and shipped galena concentrates during the latter half of the year.

CHROMITE[1]

By Lewis A. Smith[2]

CONTENTS

Page
Introduction 243
Chromite mining in the United States 244
Imports and exports 245
Consumption 247
Uses 248
Metallurgical 248
Refractories 250
Chemicals 251
Chromium plating 251
Bichromates and chromates 252
Pigments 252
Prices 253
World aspects 253
World production of chromite in 1930 253
World trade in chromite, 1928 and 1929 254
Summary of production and conditions in principal chromite producing and consuming regions of the world 255
North America 255
Canada 255
Cuba 256
Europe 256
Czechoslovakia 256

Page
World aspects—Continued.
Summary of production, etc.—Continued.
Europe—Continued.

France 256
Germany 256
Greece 257
Netherlands 258
Norway 258
Russia (Union of Socialist Soviet Republics) 258
Sweden 259
United Kingdom 260
Yugoslavia 260
Asia 261
India 261
Indo-China 262
Japan 262
Turkey 262
Africa 263
Southern Rhodesia 263
Union of South Africa 264
Oceania 266
New Caledonia 266

INTRODUCTION

The world production of chromite in 1930, responding to the widespread industrial depression, fell to about 492,000 long tons, as compared with 602,000 tons in 1929, a decrease of about 18 per cent. Reports from some of the producing countries indicated steady increases in stocks, at mines or shipping points, which necessitated curtailment of operations during the latter half of 1930. Preliminary figures for 1930 indicate a decrease in total world exports. No information is available as to the changes in stocks of chromite held by consumers.

The United States imported 327,000 long tons of chromite in 1930, as compared with 318,000 tons in 1929. This increase may be explained by increased purchases by consumers for building up stocks, coincident with the first important drop ($1 to $2 a ton) in price in several years; probable increase in the use of refractory ores due to repairing and rebuilding of idle furnaces by steel companies in anticipation of industrial recovery; and possible increase in the use of chromium in alloys. With respect to the increased use in alloys it should be noted that although the production of alloy steel ingots and castings decreased considerably the production of some of the high-chromium alloys increased substantially. For example, the production of corrosion-resistant chromium-nickel alloys is reported to have increased 10 per cent.

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[1] Work on manuscript completed July, 1931.

[2] Unless otherwise stated, statistics in this report prepared by H. M. Meyer and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

A summary of the world chromite industry in 1930 follows:

In Canada a pilot mill was projected by the Consolidated Chromium Corporation (Inc.) to treat ores from its properties near Collins and Armstrong Stations, Ontario.

Cuba continued to mine chromite in 1930, but imports into the United States from that source decreased 23 per cent.

In Europe, Germany imported about 12,600 long tons less chromite than in 1929 because of lower demand by consumers. Exports of chromite from Greece increased 21 per cent, the increase coming to the United States. In Norway steps were taken to reopen the Feragen chromite mine and to establish a plant near Oslo for the manufacture of stainless steel by the Flodin process. In Sweden the Flodin process of producing stainless steel directly from ore has apparently met with success, as firms in Norway and the United States are reported to be negotiating for rights to establish plants. Russia's production of chromite has increased materially in recent years. In 1930 Russia exported a substantial tonnage to the United States—the first Russian chromite imported into the United States since Mineral Resources began recording such imports by countries in 1912. Exports from Yugoslavia increased 54 per cent in 1930; about two-thirds of the total came to the United States as compared with one-third in 1929. Prospecting and development of the deposits in Serbian Macedonia were actively pursued.

In Asia, data on the production of chromite in India in 1930 are not yet available; exports from British Indian ports, however, increased more than 4,000 tons. An attempt is being made to determine the feasibility of manufacturing ferrochromium in Mysore. Japan continued to produce virtually all of its chromite requirements, although larger exports to Japan were reported by Southern Rhodesia. Turkish operators were beginning to feel the effect of the business depression, although imports of chromite into Sweden, Germany, and the United States from Turkey increased. The American Smelting & Refining Co. is reported to have withdrawn from its concession in the Brusa area.

In Africa, the mines of Southern Rhodesia and the Union of South Africa were forced to curtail production materially during the latter half of 1930 because of increasing stocks, poor market conditions, and active competition from relatively low-cost producers. The production in Southern Rhodesia decreased from 261,700 long tons in 1929 to 202,400 tons in 1930.

In Oceania, production of chromite in New Caledonia increased from 51,800 long tons in 1929 to 60,900 tons in 1930 and exports decreased from 58,500 long tons to 52,700 tons. The result was an accumulation of stocks. A new extraction tax of 4 per cent ad valorem on chromite was approved.

CHROMITE MINING IN THE UNITED STATES

In the United States (all in California) 310 long tons of chromite were mined during 1930 and 80 tons were shipped, as compared with 513 tons mined and 269 tons shipped during 1929. Shipments in 1930 were made by P. A. H. Arata, from the Pick and Shovel mine in San Luis Obispo County, and by J. L. Williams, from his mine in Placer County. Henry McCormick, of Alta, and D. J. Sullivan at the Beat mine, Towle, both in Placer County, and Antone Orsini at the Forest Queen mine, La Moine, Shasta County, also mined some chromite during the year. The average price paid per long ton for ore shipped during 1930 ranged from $20 to $25, and the average grade of this ore was about 50 per cent Cr_2O_3.

The International Chrome Mines (Inc.)[3] is reported to be sampling its properties at Folsom, Calif., after having finished a drilling campaign.

The Chromium Corporation, which was testing the Benbow property, Stillwater County, Mont., has been dissolved and the mine closed down.

The following table shows the production and shipments of chromite in the United States, 1925 to 1930.

Crude chromite mined and shipped from mines in the United States, 1925–1930, by States

State	Ore containing 45 per cent or more of chromic oxide			Ore containing 35 to 45 per cent of chromic oxide			Total value
	Mined (long tons)	Shipped (long tons)	Value	Mined (long tons)	Shipped (long tons)	Value	
1925							
California	83	83	$1,650				$1,650
Maryland	25	25	455				455
Oregon				47			
Washington	2						
	110	108	2,105	47			2,105
1926							
California	127	47	957		44	$22	979
Maryland	67	50	1,100				1,100
	194	97	2,057		44	22	2,079
1927							
California	50	[1]201	[1]5,063				[1]5,063
1928							
California	152	206	3,392	179	446	11,250	14,642
Maryland	12	8	165				165
Montana				25			
	164	214	3,557	204	446	11,250	14,807
1929							
California	383	182	2,712	160	87	1,264	3,976
1930							
California	235	80	1,905	75			1,905

[1] According to the quarterly report of the Division of Mines and Mining, Department of Natural Resources, California, April, 1928, p. 161, which states that 225 short tons (201 long tons) of chromite were sold in 1927. No shipments for 1927 were reported by the producers to the Bureau of Mines.

IMPORTS AND EXPORTS

The United States imported 326,617 long tons of chromite during 1930, an increase of 8,987 tons or nearly 3 per cent over 1929. This increase is significant in view of the decrease of 38 per cent in the production of alloy-steel ingots and castings and of 28 per cent in the output of all types of steel during the year. However, as the price of chromite dropped $1 to $2 per ton, it is possible that American consumers were building up stocks for future use under more favorable industrial conditions. It is also possible that the average content of chromium in alloy-steel ingots was increased by greater production of high-chromium alloys. For example, it is reported that the production of corrosion-resistant chromium-nickel alloys increased [4] 10 per cent in 1930. Imports of chromite from refractory ore sources in 1930 also amounted to slightly more than in 1929.

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[3] Arizona Mining Journal, vol. 14, No. 22, Apr. 15, 1931, p. 34.

Imports of chromite from Greece, New Caledonia, and the Union of South Africa in 1930 increased 72,[5] 16, and 39 per cent, respectively, whereas imports from Rhodesia, Cuba, and British India decreased 13, 23, and 31 per cent, respectively. Imports from Russia in 1930 amounted to 4.2 per cent of the total; this is the first record of chromite imported from Russia since Mineral Resources began showing such imports by countries in 1912.

The following table shows the percentage of the total imports of chromite coming from the most important producing countries, 1928 to 1930.

Crude chromite imported into the United States from the seven most important sources, 1928–1930, in per cent of total

Country	1928	1929	1930	Country	1928	1929	1930
Southern Rhodesia	51.74	52.70	44.61	British India	8.12	6.62	4.45
Greece	7.92	8.39	14.03	Russia			4.25
Cuba	15.56	16.67	12.55				
New Caledonia	7.00	8.45	9.50		97.61	98.35	96.85
Union of South Africa	7.27	5.52	7.46				

The following table shows the imports of crude chromite into the United States by countries, 1925 to 1930.

Crude chromite imported into the United States, 1925–1930, by countries

[General imports]

Country	1925 (long tons)	1926 (long tons)	1927 (long tons)	1928 (long tons)	1929 (long tons)	1930	
						Long tons	Value
Africa.							
British—							
East	678	1,000					
South [a]	18,463	17,794	6,935	15,745	17,545	24,376	$204,082
Portuguese—							
East [b]	70,718	105,022	128,851	112,073	167,381	145,709	1,104,729
Other	6,805	7,724	21,263	4,000		2,000	17,142
Belgium					1,367	1,595	47,860
Brazil		1,840	729	320	462	10	50
Cuba	29,830	36,020	16,983	33,707	52,949	40,982	410,534
Germany					1,700		
Greece	12,533	21,065	22,527	17,152	26,647	45,822	665,874
Guatemala		53				89	1,950
India (British)	8,360	13,800	13,572	17,591	21,033	14,542	181,175
Japan	300						
Malta, Gozo, and Cyprus				600			
Netherlands				50			
Oceania (French)	2,032	11,146	11,500	15,154	26,846	31,022	535,907
Soviet Russia in Europe						13,878	258,494
Turkey in Asia				200	1,700	2,591	34,194
United Kingdom	20					4,001	51,132
	149,739	215,464	222,360	216,592	317,630	326,617	3,513,123

[a] Beginning 1927, recorded as Union of South Africa.
[b] Beginning 1927, recorded as Mozambique.

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[4] Metal and Mineral Markets, 1930 Nickel Consumption Totaled 88,000,000 Pounds: Vol. 2, No. 13, Mar. 26, 1931, p. 11.

[5] The figure given for Greece in 1930 in the United States import table probably includes some 22,000 tons of chromite from Yugoslavia shipped through Saloniki.

The following tables show the imports of chromium alloys and compounds into the United States during the past five years.

Ferrochrome or ferrochromium, chrome or chromium metal, and chromium vanadium imported for consumption in the United States, 1926–1930, in long tons

	1926	1927	1928	1929	1930
Ferrochrome or ferrochromium:					
Containing 3 per cent or more of carbon (chromium content)	15	1	69	37	------
Containing less than 3 per cent of carbon, gross weight	495	143	611	638	153
Chrome or chromium metal	1	10	10	21	------
Chromium vanadium	20	------	------	------	------

Chromium compounds imported for consumption in the United States, 1921–1930

Year	Chromic acid		Chromate and bichromate of potash		Chromate and bichromate of soda		Chromium chloride and sulphate	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	1,969	$674	73,011	$6,772	64,236	$5,308	(1)	(1)
1922	4,663	1,289	8,584	1,676	22,731	1,540	(1)	(1)
1923	4,632	2,026	5,563	1,033	245	73	2,771	$654
1924	32,493	2,484	10,486	1,924	----------	----------	9,095	1,340
1925	5,564	2,216	4,379	778	221	46	3,520	941
1926	7,220	2,892	8,177	1,449	220	44	1,310	693
1927	15,620	9,755	5,007	906	330	67	40,650	2,419
1928	99,617	24,547	6,866	1,112	1,752	287	110	33
1929	462,486	84,683	8,880	1,537	350	80	3,823	509
1930	177,140	24,788	1,043	347	301	84	----------	----------

[1] Not separately classified prior to change in tariff, Sept. 22, 1922. None recorded Sept. 22 to Dec. 31, 1922.

Imports of chromic acid in 1930 decreased nearly 62 per cent in quantity and 71 per cent in value as compared with those in 1929 and thus reflected the depression in the chemical and automobile industries.

Imports of potassium chromate and bichromate decreased to about one-eighth the 1929 figure; imports of sodium chromate and bichromate were negligible in 1930 as in other recent years. No chromium sulphate or chloride was imported, as compared with 3,823 pounds in 1929. Exports of sodium chromate and bichromate amounted to 4,932,528 pounds, valued at $326,696, in 1930, as compared with 5,855,293 pounds, valued at $396,855, in 1929 and 8,692,088 pounds, valued at $560,777, in 1928. The steady decrease in exports is noteworthy.

CONSUMPTION

Owing to lack of data concerning consumers' stocks it is not possible to give figures covering the consumption of chromite in the United States. The following table, however, gives the apparent available supply (imports plus domestic production), 1921 to 1930.

According to these figures the apparent available supply of chromite increased 3 per cent in 1930.

Domestic sales, imports, and supply of crude chromite in the United States, 1921–1930, in long tons

Year	Sales from domestic mines	Imports (general)	Apparent available supply	Year	Sales from domestic mines	Imports (general)	Apparent available supply
1921	282	81,836	82,118	1926	141	215,464	215,605
1922	355	90,081	90,436	1927	[1] 201	222,360	222,561
1923	227	128,763	128,990	1928	660	216,592	217,252
1924	288	118,343	118,631	1929	269	317,630	317,899
1925	108	149,739	149,847	1930	80	326,617	326,697

[1] According to the Division of Mines and Mining, Department of Natural Resources, California.

USES

METALLURGICAL

The decrease in the production of alloy steel ingots and castings in 1930 indicates a decrease in the consumption of ferrochromium, but this decrease in consumption was probably lessened somewhat by the greater production of high-chromium alloys such as the "18–8" (18 per cent chromium and 8 per cent nickel) which is reported[6] to have increased 10 per cent during 1930.

In an address delivered to the New York section of the American Institute of Mining and Metallurgical Engineers, H. G. Batcheller, president of the Ludlum Steel Co., discussed the economic significance of special alloy steels. A part of his address dealing with stainless steels was summarized by Metal and Mineral Markets[7] as follows:

> The rapidly extending use of the nickel-chromium alloys, which, unfortunately, have become known as "stainless," appears to offer all essentials for a change in industry that may well prove revolutionary. The yearly loss from corrosion of iron and steel, although no reliable estimate is available, undoubtedly exceeds all other forms of economic waste. That the world will not continue to countenance such great destruction is obvious. Statistics compiled by Dr. Paul Merica, of International Nickel, show 30 per cent of the copper, 25 per cent of the lead, 85 per cent of the zinc, 25 per cent of the aluminum, and 46 per cent of the nickel produced in 1929 were used because of the corrosion-resisting qualities of these metals. The statement is frequently made that stainless alloys are too expensive to command a broad market. To anyone accustomed to think in terms of steel, a price of 25 cents a pound sounds prohibitive. Yet this infant alloy found a market during 1930 estimated at $20,000,000.

Batcheller also believes that a possible great market for stainless steels is offered in dwelling and building construction. In Germany standardized houses have been built recently of composite stainless steel sheets or copper-bearing steel sheets, formed in flanged panels which can be erected by semiskilled laborers with a screw driver and a wrench. Insulation can be made with brick, plasters, or other available material. The composite sheets cost less than straight stainless steel and are made by welding stainless steel onto a central core of soft steel.

The Friedrich Krupp A. G. of Germany now has some 50 licensees of all sorts in the United States. The various types of alloys covered by its patents have recently been symbolized in Circular Letter 65, issued by Krupp Nirosta Co. (Inc.), of New York, a subsidiary of Friedrich Krupp A. G.

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[6] Annual Report of the International Nickel Co. for the Calendar Year 1930, p. 11.

[7] Batcheller, H. G., Special Alloy Steels Being Consumed at Rate of 4,000,000 Tons Yearly: Metal and Mineral Markets, vol. 2, No. 24, June 11, 1931, p. 11.

A summary[8] of the noncorrosive group of stainless steels and irons was issued by the American Society for Testing Materials in 1930. A study[9] of world progress in the field of iron alloys was instituted late in 1930 by the Engineering Foundation in cooperation with about 60 of the important industrial and scientific organizations in the United States.

A review of the literature on the subject indicates a rough classification of alloys containing chromium, as follows:

1. Low-content structural steels in which the chromium content rarely exceeds 5 per cent and averages about 1 per cent:
   - (*a*) Straight chromium-carbon steels (chromium, 0.45 to 2 per cent; carbon, 0.25 up to 2 per cent).
   - (*b*) Chromium-nickel steels (nickel content is usually about 2 to 2½ times that of chromium which ranges from 0.45 to 1.5 per cent).
   - (*c*) Chromium-vanadium steels (chromium, 0.45 to 2.5 per cent; vanadium, 0.15 to 0.25 per cent).
   - (*d*) Chromium-molybdenum steels (chromium, 0.5 to 4.0 per cent; molybdenum, 0.15 to 0.50 per cent; nickel, up to 2 per cent in special cases).
   - (*e*) Chromium-tungsten, chromium-copper, etc., steels (chromium, up to 4 per cent; copper or tungsten, up to 3 or 4 per cent).
2. Chromium-tungsten high-speed tool steels in which chromium ranges from 3.5 to 5 per cent and tungsten from 14 to 18 per cent. Vanadium, molybdenum, or cobalt may be present in amounts up to a few per cent.
3. Valve steels in which chromium ranges from 7 to 9 per cent and silicon from 2.5 to 4 per cent.
4. Stainless steels and irons:
   - (*a*) Stainless steels contain 12 to 14 per cent chromium and 0.25 to 0.40 per cent carbon, with minor additions of manganese, silicon, and other elements according to the use to which the steel is to be put. Properties depend to considerable degree on carbon content.
   - (*b*) Stainless irons in which the chromium content ranges from 12 to 18 per cent and carbon forms less than 0.1 per cent.
   - (*c*) Super stainless steels containing 18 per cent chromium, 8 per cent nickel, and, in some cases, manganese, silicon, and other elements. Carbon ranges from 0.12 to 0.25 per cent.
5. High-chromium steels in which chromium ranges from 20 to 30 per cent, with other elements in special cases.
6. Chromium-nickel ferrous heat or oxidation resistant alloys in which chromium ranges from 10 to 29 per cent and nickel from 10 to 35 per cent, with nickel usually in excess of chromium.
7. Chromium-nickel nonferrous heat or oxidation resistant alloys in which chromium averages between 20 and 35 per cent and nickel the greater part of the remainder.
8. Chromium-cobalt-tungsten or chromium-nickel-tungsten nonferrous alloys:
   - (*a*) Chromium ranges from 25 to 35 per cent, cobalt from 25 to 60 per cent, and tungsten makes up the remainder. Molybdenum is often substituted in amounts up to 10 per cent.
   - (*b*) Chromium ranges from 20 to 35 per cent, nickel from 25 to 60, and tungsten, cobalt, or molybdenum forms the remainder.

Articles that throw considerable light on the properties and uses of the foregoing alloys are indicated by the following list:

AMERICAN METAL MARKET. Terminology of the stainless or rustless steels. Vol. 37, No. 64, Apr. 3, 1931, p. 10.

BECKER, W. A., GORDON, E. E., AND WISSLER, W. A. Discussion of cobalt-chromium-tungsten alloys. Ann. Meeting Am. Soc. Mech. Eng., New York City, Dec. 1–5, 1930.

BECKETT, F. M. Chromium-manganese steels. Am. Met. Market, vol. 37, No. 116, June 17, 1930, pp. 10–12. (Discussion of new series of high-manganese, high-chromium steels.)

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[8] Proceedings American Society for Testing Materials, Iron-Chromium, Iron-Chromium-Nickel and Related Alloys; Rept. of Committee A-10: Vol. 30, 1930, pp. 255–258 and Pls. V–XV.

[9] American Metal Market, vol. 37, No. 197, Oct. 10, 1930, p. 10.

Beckett, F. M. Chromium alloys. Min. and Met., vol. 9, October, 1928, pp. 551–554, and vol. 10, January, 1929, pp. 10–15.

Bellinger, E. St. P. Chrome iron indispensable in nitric acid plant. Chem. and Met. Eng., vol. 37, No. 11, November, 1930, pp. 691–692.

Capp, J. A. Electrical industry as a consumer of metals. Iron Age, vol. 127, No. 14, Apr. 2, 1931, pp. 1101–1102 and 1122.

Chemistry and Industry, London. Stainless steel. Vol. 49, No. 3, Jan. 17, 1930, p. B–2.

Cox, J. L. Weldless forged steel pressure vessels. Chem. and Met. Eng., vol. 37, No. 9, September, 1930, pp. 585–586.

Dean, W. A. The nickel-iron-chromium system. Rensselaer Poly. Inst., Eng. and Sci. Ser. Bull. 26, Troy, New York, June, 1930, pp. 31–55.

Fisher, F. K. An investigation of the magnetic and electrical properties of some iron-chromium alloys. Rensselaer Poly. Inst., Eng. and Sci. Ser. Bull. 28, Troy, New York, June 12, 1930, 32 pp.

Gill, G. P. High-carbon, high-chromium steels. Trans. Am. Soc. Steel Treat., vol. 15, March, 1929, pp. 387–428.

Griffiths, F. J. Fitting steels for the jobs ahead. Nation's Business, January, 1930, pp. 44–47 and 96.

Houdremont, Edward. Stainless steels, their production and properties. Metals and Alloys, vol. 2, No. 1, January, 1931, pp. 31–33.

Iron Age. Rustless steel's outlook one of continued promise. Vol. 127, No. 1, Jan. 1, 1931, pp. 84–86.

Jones, J. A. Chromium-copper structural steels. Iron and Coal Trades Rev., vol. 120, No. 3244, May 2, 1930, p. 718.

Lee, J. A. Ferrous metals to resist high temperatures. Chem. and Met. Eng., vol. 37, No. 9, September, 1930, pp. 587–588.

McKnight, Charles. Recent developments in nickel, iron, and steel. Am. Met. Market, vol. 37, No. 94, May 15, 1930, p. 8; No. 95, May 16, 1930, p. 10; and No. 96, May 17, 1930, p. 8.

MacBain, J. T. Ferro-alloys in steel production. Am. Met. Market, vol. 37, No. 54, Mar. 19, 1930, pp. 7–10.

MacQuigg, C. E. Alloy steels. Min. and Met., vol. II, No. 288, December, 1930, pp. 578–580.

Mathews, J. A. What chrome-nickel steels offer to chemical engineers. Chem. and Met. Eng., vol. 36, September, 1929, pp. 528–530.

Mining Journal, London. Special steels. Vol. 169, No. 4949, June 28, 1930, pp. 17–18.

Mitchell, Wm. Chromium iron and steels. Chem. and Met. Eng., vol. 36, September, 1929, pp. 532–534.

Newell, H. D. Seamless chrome-nickel steel tubes find diversified uses. Steel, vol. 88, No. 12, Mar. 19, 1931, pp. 31–32 and 52–53.

Parmeter, O. K. High-chromium steels. Trans. Am. Soc. Steel Treat., vol. 15, No. 5, May, 1929, pp. 796–816.

Proceedings American Society for Testing Materials. Report of subcommittee A-10. Vol. 30, 1930, Pt. I, pp. 255–258 and Pls. V–XV.

Steel. Corrosion-resistant steels meet industrial demands. Vol. 88, No. 4, Jan. 22, 1931, p. 50.

Tama, C. The refining of ferrochromium in the coreless induction furnace. Archiv. Eisenhüt. August, 1930, pp. 55–61.

Thompson, F. C. New high-strength steel alloys. Am. Met. Market, vol. 37, No. 99, May 22, 1930, p. 8.

Tull, Richard. Alloy steels and irons—bright spot on the horizon. Iron Age, vol. 127, No. 6, Feb. 5, 1931, pp. 449–451 and 527.

REFRACTORIES

Imports of chromite from Cuba, Greece, and the Union of South Africa increased from 97,141 long tons in 1929 to 111,180 tons in 1930. These ores usually run between 33 and 43 per cent Cr_2O_3 and are largely used for refractory purposes, so it would appear that there was an increase of about 14 per cent in purchases by refractory-manufacturing concerns. As the price of chromite has been relatively stable for several years the drop of $1 to $2 per ton during the latter half of 1930 may have encouraged accumulation of reserves for future use in anticipation of price advances when business conditions improve, but it is also probable that the consumption of chromite refractories increased during 1930 due to the repairing of steel furnaces which were idle because of the general industrial depression. This repairing has been done in some cases in order that the reconditioned furnaces may be ready for operation when the consumption of steel increases.

The tendency of chromite and magnesite refractories to spall under sudden changes of temperature has been overcome to some extent by the addition of diaspore and cyanite.

A method [10] for the production of high-refractory chromium slag has been worked out in Sweden by T. R. Haglund in cooperation with Friedrich Siemens A. G. and Vargons A. B. The bricks, which are formed in molds, have shown good resistivity against attack of slag at high temperatures. Chrome-slag bricks are now being manufactured on an industrial scale at Vargon, Sweden, but no details of the process have been published.

CHEMICALS

CHROMIUM PLATING

According to the latest figures released by the Bureau of the Census the production of chromic acid during 1929 amounted to 3,612,980 pounds, valued at $614,492, as compared with 898,093 pounds, valued at $241,965, in 1927. These figures indicate the progress made in the chromium-electroplating industry during the period in question.

Much advance has been made in the technology of electroplating and in the uniformity of the product. Larger units and automatic control have aided in reducing costs and improving products. One of the essential factors in the advance of a given commodity is the creating of public interest in that commodity, and this seems to have been done.

The following recent papers give valuable information relative to standard American practice:

American Metal Market. Chromium-plated aluminum ware. Vol. 38, No. 99, May 23, 1931, p. 4.

Annual Convention of American Electro-Platers' Society. Chromium plating. Toledo, Ohio, June 30, 1927.

Cuthbertson, J. W. The electrodeposition of chromium and the influence of cathode method. Metal Ind., vol. 29, No. 5, May, 1931, p. 202.

Drach, G. B., and Weisberg, Louis. Chromium as a printing surface. Metal Ind., vol. 29, No. 5, May, 1931, p. 195.

Farber, H. S. The throwing power on chromium plating. Metal Ind., vol. 28, No. 3, March, 1930, pp. 124–125.

Faris, C. H. Application of electro-deposited metals to engineering. Iron and Coal Trades Rev., London, vol. 118, No. 3175, Jan. 4, 1929, p. 5.

Fuseya, G., and Sasaki, K. Electrodeposition of chromium-iron alloy. Metal Ind., vol. 29, No. 5, May, 1931, p. 202.

Graham, A. K. Progress in electroplating. Metal Ind., vol. 29, No. 1, January, 1931, pp. 16–17.

Haring, H. E., and Barrows, W. P. Electrodeposition of chromium from chromic acid baths. U. S. Bureau of Standards, Tech. Paper 346, 1927, 41 pp.

Herrmann, K. A. The chromium electroplating tank. Metal Ind., vol. 27, No. 7, July, 1929, pp. 335–336.

Iron Age. Chromium plating increases life of Ford's gages and fixtures. Vol. 127, No. 4, Jan. 22, 1931, p. 311.

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[10] Industrial and Engineering Chemistry, News Edition, vol. 8, No. 11, June 10, 1930, p. 7.

Iron and Coal Trades Review, London. Draft regulations for chrome plating. Vol. 121, No. 3257, Aug. 1, 1930, p. 163.

McCord, W. W. The present situation as regards chromium plating. Metal Ind., November, 1929, pp. 521–522.

Metal Industry. Chromium plating regulations. Vol. 29, No. 4, April, 1931, pp. 161–163.

Metals and Alloys. Vol. 1, No. 9, March, 1930, pp. 432–433.

Moore, H. R., and Blum, Wm. Conductivity and density of chromic acid solution. U. S. Bureau of Standards Journal of Research, vol. 5, No. 2, August, 1930, pp. 255–264.

Near, N. G. Value of chromium as a finish for plumbing fixtures. Metal Ind., vol. 28, No. 11, November, 1928, p. 518.

Newell, I. L., and Kiefe, W. H. Analyzing chromium solutions. Metal Ind., vol. 29, No. 5, May, 1931, p. 206.

Saunders, R. W. Automatic temperature control of chromium plating solutions. Metals and Alloys, vol. 1, No. 8, February, 1930, pp. 368–370.

Schneidewind, Richard. A study of chromium plating. University of Michigan. Eng. Research Bull. 10, Ann Arbor, Mich., 1928, 75 pp.

——— Chromium plating patents. Metal Ind., January 20, 1928, pp. 89–92.

Work, H. K., and Slunder, C. J. Chromium deposits directly on aluminum. Metal Ind., vol. 29, No. 5, May, 1931, p. 202.

Zimmermann, R. D. Chromium plating for resistance to abrasive wear. Iron Age, vol. 127, No. 23, June 4, 1931, pp. 1829–1832.

BICHROMATES AND CHROMATES

According to preliminary figures of the Bureau of the Census the production of sodium bichromate and chromate amounted to 37,401 short tons, valued at $4,891,469, in 1929, as compared with 31,462 tons, valued at $3,780,435, in 1927. The figures for potassium chromate and bichromate are not available for publication.

The quoted price[11] of potassium bichromate averaged around 9 cents per pound until the end of October and stood at 8¾ cents at the end of the year. Sodium bichromate was constant at 7 cents per pound throughout the year.

PIGMENTS

According to the Bureau of the Census, the production of chromium green pigments during 1929 amounted to 16,351,788 pounds, valued at $2,603,225, as compared with 14,114,248 pounds, valued at $2,460,276, in 1927; chromium yellow production amounted to 16,399,268 pounds, valued at $2,392,790, in 1929, as compared with 14,334,423 pounds, valued at $2,351,111, in 1927; and chromium orange production amounted to 9,954,493 pounds, valued at $1,449,629, in 1929, as compared with 4,652,209 pounds, valued at $751,468, in 1927. The average value, based on the foregoing totals, of chromium green pigments was 15.92 cents per pound in 1929 and 17.43 cents in 1927; chromium yellow pigments averaged 14.59 cents in 1929 and 16.40 cents in 1927; and chromium orange pigments averaged 14.56 cents in 1929 and 16.15 cents in 1927.

Exports of chromium colors and iron blues in 1930 amounted to 245,200 pounds, valued at $43,008, as compared with 370,398 pounds, valued at $39,718, in 1929.

The quoted price[12] of chrome green, light, c.p., has been stable since January, 1927, at 27 cents per pound, and commercial green has been steady at 6¼ cents per pound. Chrome yellow, c.p., was constant at 17 cents per pound until the end of October when the price dropped to 16½ cents, where it stood at the end of the year.

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[11] Oil, Paint and Drug Reporter, vol. 119, No. 9, Feb. 26, 1931, p. 65.

[12] Oil, Paint and Drug Reporter, vol. 119, No. 9, Feb. 26, 1931, p. 91.

A new group of chromium blue pigments,[13] "Newport chrome blue," 2-G, WG, and WB, has been developed. These pigments are said to be particularly suited for dyeing worsted, serges, and other materials, for anthraquinone chrome blue, and for certain popular deep navy-blue shades. It is claimed that they are level dyeing and possess certain nonfading qualities. They may be used over a chrome mordant or with chrome, or they may be overchromed.

PRICES[14]

The quoted price for 46 to 47 per cent Rhodesian and Indian ores, f. o. b. eastern shipping points, was $21.50 per long ton until the last week in May, when it dropped to $20, where it remained until the middle of August. From August to the middle of December the quoted price was $19.50 for 46 to 48 per cent ore. At the end of the year the quotations stood at $19.50 to $20.50. Russian 46 to 48 per cent ore was quoted at the same price after October, when quotations on Russian ore were first published. Rhodesian and Indian 50 to 51 per cent ore was constant at $24 throughout the year. New Caledonian high-grade ore was quoted at $25 until May when it dropped to $24, where it remained until the end of the year.

Ferrochromium containing 65 to 72 per cent chromium and 4 to 6 per cent carbon was quoted throughout the year at 11 cents per pound of contained chromium on required contracts. Spot shipments commanded an extra half cent. Ferrochromium containing 65 to 72 per cent chromium and under 2 per cent carbon was quoted at 19½ cents on contract, and ferrochromium containing under 0.1 per cent carbon was quoted at 26 cents. Ferrochromium containing under 0.06 per cent carbon was priced at 28 cents.

Metallic chromium, containing 97 to 98 per cent chromium, was quoted at 95 cents to $1 per pound until July, when it dropped to 85 to 90 cents. Prices on other chromium commodities are discussed under other headings.

WORLD ASPECTS

WORLD PRODUCTION OF CHROMITE IN 1930

As production data for 1930 are far from complete it is only possible to make a very rough estimate of the total. Southern Rhodesia, New Caledonia, Cuba, and the Union of South Africa produced 323,000 metric tons during 1930, as compared with 436,000 tons in 1929, a decrease of 113,000 tons, or 26 per cent. As exports from Greece, Yugoslavia, Russia, and British India increased during 1930 compared with 1929, and as these countries are all relatively low-cost producers, it may be assumed that they produced at least as much in 1930 as in 1929. On the basis of this assumption the estimated total world production in 1930 amounted to about 500,000 metric tons, as compared with 611,000 tons in 1929.

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[13] Oil, Paint and Drug Reporter, vol. 118, No. 13, Sept. 29, 1930, p. 48.

[14] Engineering and Mining Journal, Metal and Mineral Markets: Vol. 1, Nos. 1-52, 1930. (Weekly Market—News Service).

Production of crude chromite, 1926–1930, by countries, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
Australia	607			131	171
Brazil [1]	1,500	1,820	20	70	10
Canada (shipments)				114	
Cuba [2]	36,598	17,256	34,248	53,790	41,640
Cyprus (shipments)	650	723		2,486	(3)
Great Britain		384			
Greece	20,039	17,314	20,953	24,214	(3)
Guatemala [2]	54				90
India (British)	33,918	58,125	46,185	50,991	(3)
Indo-China				11	1,451
Japan	7,052	9,782	9,808	9,101	(3)
New Caledonia	34,267	[1] 42,885	56,902	52,794	61,894
Norway [1]	17				(3)
Russia [4]	30,262	19,294	29,536	[5] 30,000	(3)
Southern Rhodesia	164,376	197,782	199,060	265,909	205,631
Turkey (Asia Minor)	6,670	18,318	11,849	15,078	28,125
Union of South Africa	12,042	16,959	31,756	63,974	13,725
United States (shipments)	143	204	671	273	81
Yugoslavia	15,983	8,757	16,678	45,022	51,576
	364,300	409,600	457,700	611,200	(3)

[1] Exports.
[2] Imports into the United States.
[3] Data not available.
[4] Year ended Sept. 30.
[5] Approximate production.

WORLD TRADE IN CHROMITE, 1928 AND 1929

A study of the flow of chromite in 1929, the latest year for which final data are available, shows that the six main producing countries consume little chromite and that the main consuming countries, except Russia, produce only negligible amounts. These facts illustrate how an important manufacturing industry may depend largely upon imported raw materials.

The total production of chromite in 1929 amounted to about 602,000 long tons, as compared with 451,000 tons in 1928, an increase of about 33 per cent. During 1929 Southern Rhodesia, New Caledonia, British India, Cuba, the Union of South Africa, and Yugoslavia furnished about 87 per cent of the total output, as compared with 84 per cent in 1928. Total world exports amounted to 503,000 long tons in 1929, as compared with 362,000 tons in 1928, an increase of about 39 per cent. During 1929 the aforementioned six countries contributed 92 per cent of the total world exports, as compared with 91 per cent during 1928. The total imports during 1929 amounted to about 444,000 long tons, compared with 350,000 tons during 1928, an increase of 27 per cent. The United States, Germany, the United Kingdom, Sweden, Norway, and France took 97 per cent of the total in 1929 and 95 per cent in 1928. The apparent consumption in 1929 amounted to about 479,000 long tons, compared with 395,000 tons in 1928, an increase of about 21 per cent. The five largest importing countries and Russia accounted for about 93 per cent of the world's apparent consumption in 1929, compared with 89 per cent in 1928. Russia and Yugoslavia were the only large consuming nations that produced sufficient chromite to meet their needs. Japan produced a large part of its own needs but apparently increased its imports somewhat in 1930. The following table shows the amount of chromite produced, exported, imported, and consumed by the principal countries in 1928 and 1929.

Chromite produced, exported, imported, and consumed by principal countries, 1928 and 1929

[The figures show the actual and relative position of producing countries in world production and exports of chromite in comparison with actual and relative imports and apparent consumption in principal countries]

Country	Production		Exports		Imports		Apparent consumption [1]	
	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total
1928								
Southern Rhodesia	195,900	43.5	162,300	45.0	--------	--------	--------	--------
New Caledonia	56,000	12.4	56,000	15.5	--------	--------	--------	--------
British India	45,500	10.1	45,300	12.5	--------	--------	200	0.1
Cuba	33,700	7.5	33,700	9.3	--------	--------	--------	--------
Union of South Africa	31,300	6.9	23,400	6.5	--------	--------	--------	--------
Russia	29,100	6.5	3,000	.8	--------	--------	26,100	6.6
Greece	20,600	4.6	17,000	4.7	--------	--------	800	.2
Yugoslavia	16,400	3.6	9,100	2.5	--------	--------	7,300	1.8
Turkey	11,700	2.6	11,700	3.2	--------	--------	--------	--------
Australia	--------	--------	(2)	(2)	--------	--------	--------	--------
Japan	9,700	2.1	--------	--------	--------	--------	9,700	2.5
United States	700	.2	--------	--------	216,600	61.8	217,300	55.0
Brazil	--------	--------	(2)	(2)	--------	--------	--------	--------
Germany	--------	--------	--------	--------	45,800	13.1	45,800	11.6
Sweden	--------	--------	--------	--------	27,600	7.9	27,600	7.0
United Kingdom	--------	--------	--------	--------	22,400	6.4	22,400	5.7
Norway	--------	--------	--------	--------	12,400	3.5	12,400	3.1
France	--------	--------	--------	--------	[3] 8,000	2.3	[3] 8,000	2.0
Czechoslovakia	--------	--------	--------	--------	2,400	.7	2,400	.6
Other countries	--------	--------	(2)	(2)	[3] 15,200	4.3	[3] 15,200	3.8
	450,600	100.0	361,500	100.0	350,400	100.0	395,200	100.0
1929								
Southern Rhodesia	261,700	43.5	251,100	50.0	--------	--------	--------	--------
Union of South Africa	63,000	10.5	44,000	8.8	--------	--------	--------	--------
Cuba	53,000	8.8	53,000	10.6	--------	--------	--------	--------
New Caledonia	51,800	8.6	58,500	11.6	--------	--------	--------	--------
British India	49,600	8.2	32,400	6.4	--------	--------	200	--------
Yugoslavia	42,300	7.0	21,100	4.2	--------	--------	1,000	.2
Russia	29,500	4.9	5,300	1.1	--------	--------	24,200	5.1
Greece	23,800	4.0	19,800	3.9	--------	--------	800	.2
Turkey	14,800	2.5	14,800	2.9	--------	--------	--------	--------
Japan	9,000	1.5	--------	--------	800	.2	9,800	2.0
Cyprus	2,400	.4	2,400	.5	--------	--------	--------	--------
United States	300	.1	--------	--------	317,600	71.6	317,900	66.3
Australia	100	--------	--------	--------	--------	--------	--------	--------
Brazil	100	--------	100	--------	--------	--------	--------	--------
Germany	--------	--------	--------	--------	41,000	9.2	41,000	8.6
Sweden	--------	--------	--------	--------	23,800	5.4	23,800	5.0
United Kingdom	--------	--------	--------	--------	27,300	6.2	27,300	5.7
Norway	--------	--------	--------	--------	11,600	2.6	11,600	2.4
France	--------	--------	--------	--------	[3] 8,000	1.8	[3] 8,000	1.7
Czechoslovakia	--------	--------	--------	--------	3,400	.8	3,400	.7
Other countries	100	--------	--------	--------	[3] 10,000	2.2	[3] 10,100	2.1
	601,500	100.0	502,500	100.0	443,500	100.0	479,100	100.0

[1] Producers' and consumers' stocks not taken into account except in the case of countries where consumption is known to be negligible.

[2] A few hundred tons of exports from Brazil, Australia, and "Other countries" unaccounted for.

[3] Estimated.

SUMMARY OF PRODUCTION AND CONDITIONS IN PRINCIPAL CHROMITE PRODUCING AND CONSUMING REGIONS OF THE WORLD

NORTH AMERICA

Canada.—A recent report by M. E. Hurst[15] of the Ontario Bureau of Mines indicates that the Obonga Lake district near Collins Station,

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[15] Hurst, M. E., Chromite Deposits at Obonga Lake 80 Miles Northwest of Port Arthur: Canadian Min. Jour., vol. 52, No. 3, Jan. 16, 1931, p. 72.

Ontario, contains five zones in which chromite deposits occur. The chromite is found in two general types of occurrences:

1. As comparatively high-grade (34 to 36 per cent Cr_2O_3) veinlike streaks, patches, and segregations.

2. As finely disseminated, low-grade (12 to 20 per cent Cr_2O_3) deposits in peridotite.

Hurst points out that the variable mode of occurrence as regards size, shape, continuity, location, and distribution makes it difficult to predict reserves or future discoveries except by extensive prospecting and development. No ore of shipping grade has been found, but the Consolidated Chromium Corporation (Inc.)[16] has projected the erection of a pilot mill to determine whether the ore will react favorably to bulk concentration. Preliminary tests indicate that a concentrate averaging 55 per cent Cr_2O_3 might be obtained.

Cuba.—Imports of chromite into the United States from Cuba, which roughly represent the total shipments from Cuba, amounted to 40,982 long (41,640 metric) tons in 1930, as compared with 52,949 long (53,799 metric) tons in 1929, a decrease of 23 per cent. The Bethlehem Cuba Iron Mines Co. produced nearly 39,000 long (39,600 metric) tons of ore in 1930 and shipped 41,600 long (42,300 metric) tons, leaving a stock on hand, December 31, 1930, of about 2,650 long (2,690 metric) tons. This material averaged 33.08 per cent Cr_2O_3, 11.75 per cent Fe, and 2.5 per cent SiO_2. Prospecting and development were reported to have been favorable.

EUROPE

Czechoslovakia.—Imports[17] of chromite into Czechoslovakia during 1929 amounted to 3,415 metric tons, as compared with 2,444 tons in 1928 and 3,558 tons in 1927.

France.—French official statistics[18] do not report chromite separately but state that general imports of ferrochromium amounted to 1,669 metric tons in 1930, as compared with 1,528 tons in 1929. Imports of chromates and bichromates amounted to 2,343 metric tons in 1930, as compared with 3,028 tons in 1929.

Prices[19] for French ferrochromium had to be lowered to meet active Swiss and Scandinavian competition. This competition is reported to have abated somewhat during the second half of 1930.

Germany.—Germany imported 28,888 metric tons of chromite during 1930, as compared with 41,695 tons in 1929 and 46,609 tons in 1928. This decrease was coincident with a general decline in imports of practically all the industrial raw materials except petroleum products and magnesite. The general world depression[20] and the gradual termination of the great reconstruction projects begun after the World War are given as the main reasons for these decreases.

The following table shows the imports of chromite into Germany, 1928 to 1930.

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[16] Skillings' Mining Review, vol. 19, No. 29, Nov. 22, 1930, p. 10.

[17] Imperial Institute, London, The Mineral Industry of the British Empire and Foreign Countries: Statistical Summary, 1927–1929, 1930, pp. 58–62.

[18] Statistique Mensuelle du Commerce Extérieur de la France, December, 1930, Paris, 1931, pp. 88 and 90.

[19] Mining Journal, London, vol. 172, No. 4986, Mar. 14, 1931, p. 212.

[20] Mining Journal, London, vol. 172, No. 4982, Feb. 14, 1931, p. 148.

Chromite imported into Germany, 1928–1930, by countries, in metric tons[1]

Country	1928	1929	1930	Country	1928	1929	1930
British South Africa	20,088	19,594	13,366	Greece	42	407	324
Portuguese East Africa	1,144	1,852	4,610	Spain	3,716	4,521	--------
New Caledonia	7,268	8,603	4,515	Russia	845	1,203	--------
Australasia	2,834	213		Other countries	476	1,544	1,285
Yugoslavia	1,669	2,576	2,541				
Turkey	--------	421	1,622		46,609	41,695	28,888
British India	8,527	761	625				

[1] Monatliche Nachweise über den auswärtigen Handel Deutschlands, December, 1930, Berlin, 1931, and annual reports for 1928 and 1929.

Imported chromite enters about the same channels of consumption in Germany as in the United States. Germany manufactures an excess of chromates and bichromates, exports of which amounted to 6,665 metric tons in 1929, as compared with 8,649 tons in 1928 and 6,847 tons in 1927. These chemicals are sent to the United Kingdom, France, Netherlands, Spain, and India.

Greece.—The production of chromite in Greece during 1929 amounted to 24,214 metric tons, as compared with 20,953 tons in 1928 and 17,314 tons in 1927. Shipments aggregated 21,618 tons in 1929, compared with 18,911 tons in 1928. Stocks on December 31, 1929, amounted to 3,891 tons, as compared with 1,295 tons on December 31, 1928. Most of the ore mined and shipped averaged about 36 to 41 per cent Cr_2O_3 and was probably used ultimately for refractory purposes. The main producers included Apostolides Frères at Pharsala and the Société Union Minière at Alchani Domokos. Less important amounts were mined at Ardouan, Fteri, Choumnico, Spourgitas, and Ineli.

The following table shows the exports of chromite from Greece, 1928 to 1930.

Chromite exported from Greece, 1928–1930, by destinations, in metric tons[1]

Destination	1928	1929	1930
Belgium	100	--------	--------
United States	12,750	17,170	24,380
Other countries	4,412	2,951	54
	17,262	20,121	24,434

[1] Bull. Min. du Com. Spécial de la Grèce avec les Pays Étrangers, December, 1930 (January to December summary).

Imports of chromite into the United States from Greece totaled 46,557 metric tons during 1930, as compared with 27,075 tons in 1929 and 17,427 tons in 1928. The figure for 1930 represents imports of ore originating in Greece and ore shipped from Yugoslavia through Saloniki.

During 1929, 84,685 metric tons of chromiferous nickel-iron ore[21] were mined and 63,216 tons were shipped by the Société des Mines d'Atalanti at Tsouka; the Société Minière "Lokris" at Larimna; and the Société Internationale des Mines at Loutsi. This material contains 2.5 to 3.0 per cent Cr_2O_3.

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[21] Greece, Direction du Service des Mines: Statistique de l'Industrie Minière de la Grèce, 1929, Athens, 1930, p. 6.

Netherlands.—Netherlands uses very little chromite but imports 1,100 to 1,200 tons of chromium compounds and transships a considerable tonnage of ore, received from producing centers, to Germany or Scandinavia.

Norway.—Norway[22] imported 19,797 metric tons of chromite in 1930, as compared with 11,748 tons in 1929 and 12,640 tons in 1928. Exports of ferrochromium amounted to 4,310 tons during 1930, as compared with 3,870 tons in 1929. Ferrochromium manufacturing industries[23] use about 3,000 kilowatt-years of hydroelectric power out of a total of 516,000 kilowatt-years used in all mineral and metal industries.

The Norske Handelsbank[24] of Oslo is reported to be negotiating the sale of its Jossingfjord plant, in west Norway, to a concern which proposes to manufacture rustless steel. This plant was formerly used as a zinc smelter by the Jossingfjord Manufacturing Co. A/S.

During 1930 a company known as the A/S Syrefast Materiel was organized[25] in Oslo and acquired factory buildings and deep-water docks at Larvik, on Oslo Fjord. Six Rennerfelt furnaces have been installed, and the rated annual capacity of the plant ranges from 40,000 to 50,000 metric tons of rustless iron or steel. The finished product will contain 13 to 20 per cent chromium. The ore will be brought from South Africa, and the necessary electric power (10,000 kilowatts) will be obtained from a local hydroelectric works at a very low rate. The process is similar to that now being operated at Avesta, Sweden.

It is reported that the Norwegian Ministry of Commerce[26] has contributed 10,000 kroner for trial operations to be started at the Feragen chromite mine which has been idle since 1919. Future shipments will be sent to Trondhjem, where smelting operations will be attempted. Norway has been dependent for several years upon foreign sources for the chromite required for its industries.

Russia (Union of Socialist Soviet Republics).—The production of crude chromite in Russia during the fiscal year 1927–28[27] amounted to 41,341 metric tons, of which 23,560 tons were directly marketable and 17,781 tons were concentrating ore; of the latter, 15,981 tons were sent to the mills and yielded 5,976 tons of concentrates. Thus, the total output of marketable ore was 29,536 tons. The Ural Province of European Russia furnished 14,836 metric tons of marketable ore and 5,946 tons of concentrates, a total of 20,782 tons; Orenburg contributed 8,401 tons; and the Bashkirian Autonomous Republic produced 323 tons of ore and 30 tons of concentrates, a total of 353 tons.

The following table shows the production of chromite in Russia, 1913 and 1923 to 1928, by regions.

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[22] Norges Offisielle Statistikk: Vareomsetningen med Utlandet, December, 1930, Oslo, 1931.
[23] Canadian Mining Journal, vol. 51, No. 51, Dec. 19, 1930, p. 1221.
[24] Metal Bulletin, London, No. 1581, Mar. 31, 1931, p. 9.
[25] Lund, M. H., Commercial attaché, Oslo, Commerce Repts. 12, 1931, p. 757.
[26] Mining Journal, London, vol. 172, No. 4988, Mar. 28, 1931, p. 250.
[27] Statistical Summary of the Mineral Industry of the U. S. S. R. for 1927–28, Moscow, 1930, pp. 192–195.

Chromite produced in Russia, 1913 and 1923–1928, by regions, in metric tons

Region	1913	1923[1]	1924[1]	1925[1]	1926[1]	1927[1]	1928[1]
Ural Province	24,920	875	8,773	22,117	26,622	13,015	20,782
Government of Orenburg				87			8,401
Bashkirian Autonomous Republic	1,296	17	3,121	4,991	3,740	6,279	353
Kazaksky Autonomous Republic				2,916			
	26,216	892	11,894	30,111	30,362	19,294	29,536

[1] Year ended Sept. 30.

The chromite-mining industry[28] in Russia is handled mainly by three concerns—the Middle Volga Trust, the Urals Mining Trust, and the Bashkirie Mining Bureau. A central trust comprising the total activities of these three concerns has been proposed in order to eliminate duplication of effort. The proposed organization would undertake the pursuance of all prospecting and development work in the Ural and Orsk-Troitsk regions.

Exports[29] of chromite during the first 10 months of the fiscal year ended September 30, 1930, amounted to 8,669 metric tons, as compared with 5,374 tons in the 12 months of 1928–29, 3,005 tons in 1927–28, and 2,328 tons in 1926–27.

The United States imported 14,101 metric tons of chromite from Russia during the calender year 1930.

The first electric furnace[30] of the Russian ferro-alloy plant, in course of construction at Cheliabinsk in the Urals, has begun operations, and it is reported that during the early part of 1931 five additional furnaces will begin work. The entire plant was scheduled to be in full operation by the beginning of May, 1931. This plant will make ferrochromium, ferrosilicon, ferrotungsten, and other alloys previously imported.

A young soviet scientist,[31] U. E. Aleksievsky, is reported to have developed an entirely new method of preparing low-carbon ferrochromium. It is said that the process is simple and should be in commercial operation in the near future. The alloy produced by experimentation contained 63 per cent chromium, 1.5 per cent aluminum, 0.15 per cent oxygen, 0.004 per cent nitrogen, and 0.32 per cent carbon. Later work indicated that the carbon content could be reduced to 0.2 per cent.

Sweden.—Imports[32] of chromite into Sweden in 1929 amounted to 24,225 metric tons, as compared with 28,077 tons in 1928. The following table shows the imports of chromite into Sweden during 1928 and 1929.

Chromite imported into Sweden, 1928 and 1929, by countries, in metric tons[a]

Country	1928	1929	Country	1928	1929
Germany	3,345	13,320	British India	502	611
United Kingdom	23,346	7,111	Brazil		161
Belgium	314	1,207	Other countries	290	8
Turkey in Asia		1,125			
Russia	280	682		28,077	24,225

[a] Sveriges Officiella Statistik: "Handel" for 1928 and 1929, Commodity Pt. I, 20*a*, p. 192.

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[28] Mining Journal, London, vol. 170, No. 4950, July 5, 1930, p. 555.

[29] Metal Bulletin, London, No. 1575, Mar. 10, 1931, p. 8.

[30] Metal Bulletin, London, No. 1544, Nov. 18, 1930, p. 15.

[31] Russian Economic Notes, Discovery of a New Process for Manufacturing a Ferro-Alloy: No. 124, Mar. 27, 1931, p. 8.

[32] Sveriges Officiella Statistik: "Handel" for 1928 and 1929, Pt. I, 20*a*, Stockholm, 1930, p. 192.

The production of ferrochromium with a low carbon content has grown into a large industry in Sweden due largely to adequate and relatively cheap water power and important achievements in metallurgical research. The new process[33] described below is designed to produce steel directly from ore.

> Among the numerous processes aiming at the production of steel direct from ore, the Flodin process, which was briefly mentioned in my March letter [News Edition, 7, 7 (April 10, 1930)] is considered the most promising. According to the latest statements, soft steel can be produced in a 1,500–1,800 kilowatt furnace of this type at an energy consumption of 2,200–2,500 kilowatt-hours per 1,000 kilograms steel. The carbon content can be regulated by varying the amount of coal in the briquets composing the charge. It is possible to reduce the content of foreign substances to 0.15 per cent of C+Mn+Si+P+S in the soft steel. Noncorroding chromium steel can also be produced direct from mixed ore in the Flodin furnace, as well as manganese steel, thus eliminating the use of the expensive ferrochrome and ferromanganese. Lately Flodin has succeeded in producing spongy iron from coal-ore-lime briquets in a furnace of this type and has found that the heat obtained by burning the formed carbon monoxide will nearly suffice to cover the heat demand of the process. The consumption of electric energy is then reduced to 650–700 kilowatt-hours per 1,000 kilograms iron, and the smelting time is also reduced. The Flodinjärn Co., which exploits these processes, is negotiating for the erection of a Flodin steel plant in the United States and another in Norway.

United Kingdom.—In 1929, 27,276 long (27,714 metric) tons of chromite were imported into the United Kingdom, as compared with 22,386 long (22,745 metric) tons in 1928, as shown in the following table.

Chromite imported into the United Kingdom, 1928 and 1929, by countries, in long tons[1]

Country	1928	1929	Country	1928	1929
Portuguese East Africa	11,064	11,894	British India	1,824	1,000
Southern Rhodesia	5,403	7,658	Other British colonies	1,250	2,485
Portuguese India	2,037		Other countries	808	2,911
New Caledonia		1,328			
				22,386	27,276

[1] Annual Report of the Trade of the United Kingdom with Foreign Countries and British Possessions for 1929, London, 1930.

Imports during the past six years have been as follows:

Chromite imported into the United Kingdom, 1924–1929, in long tons

1924	26,120	1927	17,773
1925	21,040	1928	22,386
1926	7,063	1929	27,276

The United Kingdom imported 2,598 long tons of bichromates during 1929 but exported 2,800 tons, a net export of 202 tons. Ferrochromium manufactured in the United Kingdom is largely used at home, and only a relatively small amount is imported or exported.

Yugoslavia.—Yugoslavia produced 51,576 metric tons of chromite in 1930, as compared with 43,022 tons in 1929 and 16,678 tons in 1928. Exports amounted to 33,060 metric tons in 1930 and 21,445 tons in 1929.

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[33] Robak, C. A., Scandinavia, Recent Developments in Technical Electrochemistry: Ind. and Eng. Chem., News Ed., vol. 8, No. 11, June 10, 1930, p. 7.

Chromite exported from Yugoslavia, 1929 and 1930, by destinations, in metric tons[1]

Destination	1929	1930	Destination	1929	1930
United States	7,058	22,194	Greece	5,623	615
France	1,150	4,002	Czechoslovakia	1,925	184
Germany	2,295	2,727	Other countries	1,424	756
Rumania	30	1,800			
Austria	1,940	782		21,445	33,060

[1] Statistique du Commerce Extérieur du Royaume de Jougoslavie, 1930 and 1929: Belgrade (Imprimerie Nationale, Ministère des Finances).

In the latter part of 1929 Yugoslavia[34] began exporting through Saloniki.

ASIA

India.—The production of chromite in India during 1929 was 49,565 long (50,361 metric) tons, as compared with 45,455 long (46,185 metric) tons in 1928, an increase of 4,110 long (4,176 metric) tons. Figures for 1930 are not yet available.

The following table shows the quantity and value of the chromite produced in India, 1927 to 1929, by States and districts.

Chromite produced in British India, 1927–1929, by States and districts

	1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value
Baluchistan: Zhob	14,534	£16,270	15,002	£16,793	17,905	£19,908
Bihar and Orissa: Singhbhum	2,552	3,689	2,165	3,653	3,149	5,107
Mysore State:						
Hassan	34,030	36,423	23,639	28,806	22,799	27,756
Mysore	6,091	9,361	4,649	7,887	5,712	10,047
	57,207	65,743	45,455	57,139	49,565	62,818

A large part of the chromite produced in India is exported. Some of it is shipped from British Indian ports and some is shipped from Mormugão, Portuguese India. The total exports in 1929 amounted to 32,402 long tons, of which 18,159 tons were shipped from British Indian ports and 14,243 tons from Mormugão.

The following table shows the exports of British Indian chromite, 1928 to 1930.

Chromite from British India exported, 1928–1930, in long tons

	1928	1929	1930
From British Indian ports to—[a]			
United States	3,920	5,250	7,450
Germany	8,300	10,300	5,000
United Kingdom	1,060	1,250	3,250
France	4,800	50	700
Other countries	13,129	1,309	6,098
Total from British Indian ports	31,209	18,159	22,498
From Portuguese Indian ports	14,099	14,243	([b])
Grand total	45,308	32,402	([b])

[a] Sea-Borne Trade and Navigation of British India for the calendar year of 1930, pp. 104–105.
[b] Information not available.

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[34] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 335, May 2, 1931, p. 2.

During the fiscal year ended March 31, 1929, experiments[35] in the manufacture of ferrochromium were conducted in Mysore State; they proved sufficiently successful to warrant the purchase of larger equipment for more extensive experiments.

Indo-China.—The Société Chrome et Nickel de l'Indochine,[36] founded in 1928, is exploiting alluvial chromite deposits that contain ore running 4 to 5 per cent Cr_2O_3. These deposits occupy the bottoms of numerous little valleys draining the periphery of the central mass of the Nui-Nua and Nui-Na-Son Mountains in the Province of Thanh-Hoa, 20 kilometers southwest of a village of the same name. A concentrator was installed during 1929; since the beginning of 1930 the company is said to have been producing at the daily rate of about 30 to 40 tons of concentrates averaging 53 per cent Cr_2O_3. The chromite is recovered as fine crystals. The mill is composed of washing drums to remove clay and primary concentrating washers, followed by concentrating tables.

The Société Coloniale des Mines has an option on ground lying outside that of the Société Chrome et Nickel de l'Indochine but thus far has not exercised its options.

Japan.—Japan produced 9,163 metric tons of chromite in 1929, as compared with 9,808 tons in 1928 and 9,782 tons in 1927. The ore is largely from the Wakamatsu district in the Province of Hoki and averages 40 per cent Cr_2O_3. Other deposits have been found on the upper courses of the Mukawa River in the Province of Iburi. The total output is consumed at home. In Japanese import statistics chromite is not reported separately. Exports of about 700 tons of chromite to Japan in 1929 were reported by Southern Rhodesia.

Turkey.—The production of chromite in Turkey during 1930 amounted to 28,325 metric tons, compared with 15,078 tons in 1929, 11,849 tons in 1928, and 18,318 tons in 1927. The major part of the 1930 production came from around Kutahia, Mugla, and Eskishehr. Recent slumps in metal prices are reported to have resulted in a setback to mining development in Turkey during the latter half of 1930. Coincident with this, the American Smelting & Refining Co.,[37] which was actively prospecting in central and northern Asia Minor during 1928 to 1930, is said to have withdrawn.

Recent reports indicate that little work has been done east of Eskishehr, where the ore runs only 35 to 40 per cent Cr_2O_3 and 10 to 15 per cent iron, and only one large deposit (Kavak) has been located. It has been estimated that this property is capable of producing several thousand tons of washed ore annually. On the other hand, considerable funds and effort have been expended on deposits west of Eskishehr, where the crude ore runs 40 to 50 per cent Cr_2O_3 and the washed product about 55 per cent. Transportation facilities are fairly good in this area, and a number of deposits of considerable size have been located between Dagh Ardy and Eskishehr. The Société Anonyme des Mines Turques[38] operates one of the most important deposits, the Tavshanly mine in the Kutahia (Kutaia) district, and produces several thousand tons of chromite annually.

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[35] Mining Journal, London, vol. 171, No. 4972, Dec. 6, 1930, p. 959.

[36] Echo des Mines et de la Métallurgie, Paris, 59th year, Jan. 10, 1931, p. 51.

[37] Metal Bulletin, London, No. 1591, May 12, 1931, p. 8.

[38] Metal Bulletin, London, No. 1544, Nov. 18, 1930, p. 15.

The most important deposits in the southern area are around Denizli and Tefeni, where the ore runs 50 to 54 per cent Cr_2O_3. Other deposits are reported around Makri, Mersina, and Adalia, in the southern coastal belt, where the ore is said to average 42 to 45 per cent Cr_2O_3. French and British interests are reported to be undertaking systematic prospecting in this region.

AFRICA

Southern Rhodesia.—The production of chromite in Southern Rhodesia amounted to 205,631 metric tons in 1930, as compared with 265,909 tons in 1929, a decrease of nearly 23 per cent. Virtually all the decline took place in the last quarter[39] of the year, as production to the end of September had reached 183,740 tons, as compared with 185,194 tons for the corresponding period in 1929. The mines at Selukwe began restricting output and retrenching late in the year, although no shutdowns were reported. Large supplies[40] of ore had accumulated late in October at the mines and at Beira (the port of export in Portuguese East Africa). It is said that production will be restricted until existing stocks have been materially reduced.

Producers of chromite in Southern Rhodesia apparently were unable to maintain their position in the world market at prices prevailing in 1930. Exports[41] of chromite from Southern Rhodesia during 1930 amounted to 174,449 metric tons, as compared with 255,173 tons in 1929 and 164,872 tons in 1928.

The following table shows the exports of chromite from Southern Rhodesia, 1927 to 1930.

Chromite exported from Southern Rhodesia, 1927–1930, by destinations, in metric tons[1]

Destination	1927	1928	1929	1930
United States	118,444	88,585	186,752	(3)
United Kingdom	19,416	48,280	47,407	
Portuguese East Africa		4,048	6,894	
Norway		3,048	4,064	
Netherlands[2]	15,608	9,185	2,696	
Germany	2,055	3,963	2,540	
Italy	1,727	4,691	2,258	
Belgium	2,896	579	944	
France	3,325	2,377	816	
Japan		51	711	
Other countries		65	91	
	163,471	164,872	255,173	174,449

[1] Report of Comptroller of Customs and Excise, 1929, Salisbury, Southern Rhodesia, 1930, p. 655.
[2] Probably for transshipment to Germany and Scandinavia.
[3] Details not yet available.

The decline in exports in 1930 can not be wholly attributed to the industrial depression, as in some of the largest consuming countries Rhodesian ore was replaced to some extent by ore from other sources. In the United States imports of chromite from Portuguese East Africa (largely Rhodesian ore) decreased 13 per cent, notwithstanding an increase of 3 per cent in total imports. This decline was more than offset by increased imports from British South Africa, Yugoslavia (shipments via Greece), Russia, and other countries. These countries are generally considered to be low-cost producers, whereas Southern Rhodesia is said to be a relatively high-cost producer owing to the long rail haul to shipping ports.

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[39] Metal Bulletin, London, No. 1540, Nov. 4, 1930, p. 15.

[40] South African Mining and Engineering Journal, The Chrome Industry: Vol. 41, pt. 2, No. 2038, Oct. 18, 1930, p. 158.

[41] Trade of Southern Rhodesia, Monthly Summary: December, 1930, Salisbury, Southern Rhodesia, 1931, p. 17.

The Chrome Corporation (Ltd.) now has more than 200 blocks of claims in the Umvukwes Hills sector, along the Great Dyke. These holdings include 144 blocks recently acquired from the Great Southern Rhodesia Chrome Co. (Ltd.) and 71 blocks bought from Kimpton & Hepker. Of the Great Southern Rhodesia group, 93 blocks follow along the west side of the Great Dyke a total distance of 24,000 feet, and 51 blocks are on the east side of the Dyke; both groups lie north of the Moquadzi River. The Kimpton group consists of 71 claims located on both sides of the Dyke and extending a total distance of 20,000 feet south from the Moquadzi River. Five fairly persistent seams are exposed in these areas on some portion of the blocks. Incomplete prospecting to date indicates persistency in depth, but estimates of ultimate reserves per given unit of area can not be made with present knowledge. The Kimpton blocks are 12 miles and the Great Southern Rhodesia blocks 17 miles from the railway at the nearest point. As the wagon roads in both cases are poor and impassable during the rainy season the Chrome Corporation has entered into an agreement with the Rhodesia Railways whereby the latter is to build a branch line from Trelawney Siding to the northern part of the Great Southern Rhodesia blocks. The line will follow within a few hundred feet of the chromite outcrops and will have sidings at convenient places. When the line is completed this district will be one of the best-served sections along the Great Dyke. It is said that the cost of mining and delivering chromite on board cars will be reduced to about 16s. ($3.85 to $3.90) per short ton. The ore in this portion of the Dyke runs about 48 to 50 per cent Cr_2O_3.

The new railway from Maryland Siding, on the Salisbury to Sinola branch and 48½ miles from Salisbury, to Farm Kildonan, begun in July, 1929, was finished in June, 1930. It follows the western side of the Umvukwe Range and is about 24½ miles long.

Union of South Africa.—Shipments of chromite in South Africa (Transvaal) decreased from 40,318 metric tons in 1929 to 22,894 tons in 1930, or 43 per cent. Exports [42] during 1930 amounted to about 23,000 metric tons, a decline of nearly one-half from the 44,700 tons exported in 1929.

The following table shows the exports of chromite from the Union of South Africa, 1928 to 1930.

Chromite exported from the Union of South Africa, 1928–1930, by destinations, in metric tons

Destination	1928 [a]	1929 [b]	1930 [c]
United States	10,589	([d])	([d])
Netherlands	9,792		
United Kingdom	1,784		
Sweden	501		
Other countries	1,074		
	23,740	44,716	23,033

[a] Trade of the Union of South Africa, Ann. Rept., 1928, Pretoria, 1929.
[b] Trade of the Union of South Africa, Ann. Rept., 1929, Pretoria, 1930.
[c] Trade of the Union of South Africa, Monthly Statements: December, 1930, Pretoria, 1931.
[d] Details not yet available.

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[42] Trade of the Union of South Africa, Monthly Statements: December, 1930, Pretoria, 1931, p. 11.

It has been stated that much of the mining in 1930 was carried on to meet existing contracts. Data are not available showing the extent to which new contracts were entered into in 1930. On account of their low grade Transvaal chromites have been marketed at prices about 25 per cent lower than Rhodesian ore. Notwithstanding this price differential, opinion is divided as to the economy of Transvaal ores. Some claim that in times of depression consumers will turn to the cheaper Transvaal ores, whereas others state that the higher-grade ores are the more economical in the long run. In view of the 48 per cent decrease in Transvaal exports, there appears to have been little tendency on the part of consumers to substitute Transvaal ore for other ore during 1930.

Boyden[43] summarizes the situation in Transvaal as follows:

> One of the greatest difficulties with chrome ore and also with all other base metals and minerals exported from this country is that a very considerable proportion of the oversea price (in the case of chrome ore, varying between 70 per cent and 80 per cent) consists of charges over which the producers have no control, as, for instance, railage, shipping charges, and freights, etc. The consequence is that if there happens to be a fall in price overseas of approximately 5 per cent, which, by the way, is a very small drop, the same has to be made up by reducing the production charges, which means that the producers are only obtaining between 15 per cent and 25 per cent of the overseas price, free on rail. In addition, out of this f. o. r. price, other charges have to be paid, such as transport and royalties, which the producers can not, of course, reduce. The outlook for Transvaal chrome is, however, distinctly encouraging, and there can be no doubt that consumption will increase surprisingly in the course of the next 10 years, provided that present difficulties can be removed. This confidence is based on the fact that Transvaal chrome is being marketed at substantially lower prices than the Rhodesian variety, the difference being in the neighborhood of 25 per cent, in favor of the Transvaal.
>
> Manufacturers who are using the Transvaal product will, in these times of severe competition, give more attention to the lower grades than they have done in the past. Of course, a lot depends on the trend of overseas prices during the next few years, because unless there is a substantial difference in price between the Transvaal ore, as compared with the high-grade ores of Rhodesia and Russia, then there would be nothing to encourage consumers to continue using Transvaal chrome ore for certain processes. Owing to its high iron content, Transvaal chrome ore can not be used for making ferrochrome, but reliance is placed on its value in chemical factories and in the manufacture of bricks, chrome cement, and other commodities to give a big fillip to consumption.
>
> The position of Rhodesian chrome ore is different, because there has been, during the last 15 years, a very substantial and steady market for this ore, and the Rhodesian producers are, at present, supplying the bulk of the chrome ore which is being consumed in overseas countries, although, even in this commodity, a decrease in the market value has taken place. The drop in price during 1929 was, approximately, 10 per cent, and competition has affected export from Rhodesia during the past few months very substantially, all of which points to the urgent need of Empire tariff reform.

In the same article Boyden gives the following data on the cost of producing chromite in Transvaal:

> During May, 1929, there were actually quarried and transported to Steelpoort Station 1,529 tons of ore averaging 43.6 per cent chromic oxide. The cost of quarrying and loading the ore at the mine amounted to 3s. 10d. per ton, and transport and loading at the station absorbed a further 5s. 1.9d., making a total cost, delivered on rail, of 8s. 11.9d. per ton. The ore was worth £1 11d. per ton delivered on rail at Steelpoort Station. Allowing 1s. 6d. per ton for administration and head office expenses, the profit worked out at 10s. 11d. per long ton.

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[43] Boyden, A. G., The Union's Wealth in Chrome Ore: Min. and Ind. Mag. So. Africa, vol. 11, No. 8, Dec. 10, 1930, pp. 271–273.

Conditions are favorable here for cheap adit mining at about 6s. per ton. This example will answer roughly for the costs and profits prevailing on the other Transvaal mines belonging to the Chrome Corporation. Such an estimate is necessarily based on existing transport arrangements. The corporation is at present in negotiation with the Government for railway extensions to the several mines. The Railway Board met representatives of the corporation and other interested companies in June of the present year to consider the question of the extension of the Lydenburg-Steelpoort railway line. The board was sympathetic and was prepared to recommend the extension on condition that a sufficient tonnage was guaranteed. Needless to say, such an extension would result in a decrease of working costs and promote more expeditious handling and transport of the ore.

OCEANIA

New Caledonia.—During 1930 New Caledonia produced 61,894 metric tons of chromite and shipped about 53,250 tons which averaged 53 per cent Cr_2O_3, as compared with 52,594 tons produced and 59,239 tons shipped in 1929. Thus, stocks of ore at the mines were increased by 2,000 tons during the two years. The decrease in shipments in 1930 was due largely to the decline in shipments by the Société Caledonia. Exports in 1930 amounted to 53,521 metric tons, as compared with 59,423 tons in 1929, a decrease of 5,902 tons.

Shipments[14] of chromite in 1929 and 1930 by the three leading producers are shown in the following table:

Chromite shipped by leading chromite-producing companies in New Caledonia, 1929 and 1930, in metric tons

Company	1929	1930
Société la Tiébaghi	27,382	28,600
Société Chimique du Chrome	19,990	20,932
Société Caledonia	11,867	3,413

The reserves of chromite in New Caledonia were estimated to be about 1,500,000 tons of 50 per cent plus ore in 1925.

A decree[15] dated May 29, 1930, approves a decision of the General Council of New Caledonia dated December 12, 1929, whereby an extraction tax on chromite will be levied up to 4 per cent ad valorem.

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[14] Echo des Mines et de la Métallurgie, Paris, 59th year, Apr. 10, 1931, p. 319.

[15] Bureau of Foreign and Domestic Commerce, Foreign Trade Notes, No. 297, July 12, 1930, p. 4.

COBALT, MOLYBDENUM, TANTALUM, TITANIUM, AND VARIOUS RARE METALS[1]

By Paul M. Tyler and Alice V. Petar[2]

CONTENTS

Page
Introduction 267
Cobalt 271
  General conditions 271
  New occurrences of cobalt ore 274
  World production 276
  Bibliography 276
Molybdenum 277
  Domestic production 277
  Prices 278
  Imports and exports 278
  World production 279
    Canada 279
    Norway 279
    Russia 279
  Uses 279
  Bibliography 280
Tantalum 282
  General conditions 282
  Domestic production 283
  Imports 283
  Uses 283
  Bibliography 284
Titanium 286
  General conditions 286
  Domestic production 289
  Imports 290
  World production 290
  The industry in foreign countries 291
  Bibliography 291

INTRODUCTION

Of the total number of elements accepted by chemists—92—64 or more are generally used more or less accurately as essentially metallic. Each of these so-called metals has distinctive properties; most of them, in fact, differ radically from one another in physical as well as chemical characteristics. Until about 30 years ago, however, the world found direct use for scarcely a dozen of these elements in their metallic state. A suitable process for producing aluminum economically on a large scale was discovered a little over 40 years ago, but it took a decade or more even for that metal to be classed among those in fairly common use. For thousands of years ordinary industrial needs were satisfied with respect to metals mainly by iron, copper, lead, and zinc, with minor amounts of tin and antimony. As late as the beginning of the present century mercury and bismuth, which found a small use in medicine and in the arts, and the precious metals—gold, silver, and platinum—virtually completed the list of useful metals. Manganese and silicon were available, but only in the form of mechanically worthless alloys used almost exclusively in steel making, chiefly for their oxidizing properties. Nickel and a very few other metals were likewise available, but they were employed mainly as modifying additions in steel and other alloys.

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[1] Work on manuscript completed June, 1931.

[2] Statistics on domestic production prepared by H. W. Davis and figures on foreign production compiled by L. M. Jones, both of the Bureau of Mines. Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

By 1930 the number of metals in active use had more than doubled, and experiments are constantly under way to put still others to work. A new element, No. 87 in the periodic arrangement of the elements in the order of their increasing atomic weights, was glimpsed in 1930 by Dr. Fred Allison and Edgar J. Murphy, working at the Alabama Polytechnic Institute. Early in 1931 the same scientists with two associates announced that they had also discovered No. 85, the last of the missing units of the fundamental chemical structure. Rhenium (75) and masurium (43) were isolated in 1925 and 1926 at the University of Berlin; illinium (61), the hitherto unidentified member of the rare-earth group, was found by Hopkins at the University of Illinois in 1926; and hafnium (72) was separated from its twin, zirconium, by Coster and Hevesy in Copenhagen in 1923. Most of these newly discovered elements, however, are probably far too scarce to permit them to assume the burden of any large share of the world's work; nevertheless, intensive research has already been instituted to develop potential commercial applications for at least two of them.

Periodic table of the elements [1]

Series	Group O	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
1		**H**(1) 1.008							
2	**He**(2) 4.00	**Li**(3) 6.94	**Be**(4) 9.02	**B**(5) 10 .82	**C**(6) 12.00	**N**(7) 14.01	**O**(8) 16.00	**F**(9) 19.00	
3	**Ne**(10) 20.18	**Na**(11) 23.00	**Mg**(12) 24.32	**Al**(13) 26.97	**Si**(14) 28.06	**P**(15) 31.02	**S**(16) 32.06	**Cl**(17) 35.46	
4	**Ar**(18) 39.94	**K**(19) 39.10	**Ca**(20) 40.08	**Sc**(21) 45.10	**Ti**(22) 47.90	**V**(23) 50.95	**Cr**(24) 52.01	**Mn**(25) 54.93	**Fe**(26), **Co**(27), **Ni**(28) 55.84 58.94 58.69
5		(29)**Cu** 63.57	(30)**Zn** 65.38	(31)**Ga** 69.72	(32)**Ge** 72.60	(33)**As** 74.93	(34)**Se** 79.2	(35)**Br** 79.92	
6	**Kr**(36) 82.9	**Rb**(37) 85.44	**Sr**(38) 87.63	**Y**(39) 88.92	**Zr**(40) 91.22	**Cb**(41) 93.3	**Mo**(42) 96.0	**Ma**(43) 96?	**Ru**(44), **Rh**(45), **Pd**(46) 101.7 102.91 106.7
7		(47)**Ag** 107.88	(48)**Cd** 112.41	(49)**In** 114.8	(50)**Sn** 118.70	(51)**Sb** 121.76	(52)**Te** 127.5	(53)**I** 126.93	
8	**Xe**(54) 130.2	**Cs**(55) 132.81	**Ba**(56) 137.36	**Rare earths** (57–71)	**Hf**(72) 178.6	**Ta**(73) 181.4	**W**(74) 184.0	**Re**(75) 186.31	**Os**(76), **Ir**(77), **Pt**(78) 190.8 193.1 195.23
9		(79)**Au** 197.2	(80)**Hg** 200.61	(81)**Tl** 204.39	(82)**Pb** 207.22	(83)**Bi** 209.00	(84)**Po** 210.	—(85) ?	
10	**Rn**(86) 222.	—87 ?	**Ra**(88) 225.97	**Ac**(89) 230	**Th**(90) 232.12	**Pa**(91)	**U**(92) 238.14		

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[1] Atomic weights from Baxter, G. P., and others. First report of the Committee on Atomic Weights of the International Union of Chemistry: Jour. Am. Chem. Soc., vol. 53, May, 1931, p. 1637.

Among the alkali group, constituting the first column of the familiar periodic table credited to Mendeleef, metallic sodium long occupied the place of a chemical curiosity, but with the development of the dye industry it began to be used at the rate of many thousands of tons annually, chiefly, however, as a reducing agent in the production of vat-dye indigo and other organic chemical processes. Potassium metal, to a minor extent, is used for similar purposes. Lithium, on the other hand, has begun to attract attention as an alloying element with lead and with aluminum, and as an oxidizing agent for copper. In 1923 a plant was erected in Germany for producing lithium by an improved process on a fairly large scale—"thousands of kilos a year," according to a statement of Metallgesellschaft.[3] Lead hardened by lithium and calcium is said to have displaced other types of bearing metals almost completely on German State Railways. Originally the use of lithium was forced upon the Germans by war-time necessity, but it survived postwar conditions despite a fall in the price of tin and other hardening agents more commonly employed. Caesium and rubidium, the least common of the alkali group, although still used almost exclusively in the form of compounds, have found employment in the manufacture of photo-electric cells.

In the second group of the periodic chart magnesium and cadmium have emerged from the ranks of rare metals almost wholly within the space of a single decade; already they rival mercury, although of course they are far behind zinc (the leading member of the same family) in point of production. Calcium and barium have been employed in lead alloys for a number of years, and new uses are fast being found for them. A calcium alloy, for example, may be used to produce porous concrete with hydrogen gas as a by-product. Barium metal was first produced in the United States on what might be called a commercial scale in 1929, but it has become rather important as a minute addition to nickel wire used in rather large quantities in automobile ignition equipment. It is also employed by the radio industry as a "getter" for vacuum tubes, for which purpose it is supplied in the form of copper-coated wire (extruded) that can be cut up into tiny pellets. The price, formerly several hundred dollars a pound, was promptly reduced to about $35 as soon as a moderately substantial demand was recognized. Metallic strontium has also been made available in the last year or two but has not yet found a definite place in the ranks of commercial metals. Radium, by far the heaviest member of this second group, appears destined to remain a rare element because of its apparent scarcity; beryllium, the lightest of the group, has recently achieved a remarkable amount of publicity. Because of its low specific gravity and other favorable physical properties systematic efforts have been made to enable this metal to be used industrially on a substantial scale. Suitable processes for producing beryllium economically have been developed both in the United States and Germany, and a host of attractive outlets appear to await the time when a dependable supply of the metal becomes available at prices under $20 a pound. For the moment, however, prospective producers are still seeking assurance that ore supplies warrant the large development expense incident to creating a market and introducing a new product. Prices meanwhile are quoted around $145 a pound, and consumption is almost wholly of an experimental character.

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[3] U. S. Bureau of Foreign and Domestic Commerce, German Utilization of Lithium: Foreign Trade Notes 281, Feb. 26, 1930, pp. 1 and 2.

In the third group of elements aluminum seems to be the only metal sufficiently abundant in the earth's crust to have great industrial importance from a tonnage standpoint, although the large expansion that has occurred recently in the use of boron, usually classed as a nonmetal, may be mentioned. A small business in thallium has been created (chiefly in rat poison) and the use of pyrophoric alloys containing cerium and other elements of the rare-earth group for sparking flints in pocket lighters has grown considerably. Gallium has been tried in high-temperature thermometers, but all the elements in this group except aluminum and boron seem destined always to be classed as rare.

The same deduction applies also to germanium and to thorium in the fourth group, and probably also to hafnium, though to a much less degree. The use of zirconium is on the increase, a relatively new development being a growing use of the powdered metal for flashlight purposes and as a "getter" in radio vacuum tubes. Titanium, which is included in a later section of this chapter (see p. 286), is becoming quite well known—not so much as a metal, however, as for its use in pigments.

In the remaining columns of the table the only elements that can still be called strictly rare are tantalum and columbium (its sister element), the radioactive group, and the newly discovered elements mentioned in a foregoing paragraph of this chapter. Molybdenum and cobalt, though still included in the present chapter as "rare metals," are now used quite widely, and the production of molybdenum in particular has become an important commercial enterprise in the United States.

COBALT

GENERAL CONDITIONS

No substantial production of cobalt has been reported in the United States since 1920 when the refinery at Fredericktown, Mo., closed down. In 1921 some 20 tons of ore containing about 10 per cent cobalt were produced in Nevada; this was shipped in the following year. No subsequent production has been reported to the Bureau of Mines. Consumption, therefore, is represented more or less closely by imports. In recent years the imports increased rapidly until 1930, when the demand for cobalt, in common with that for other metals, seemed to have been greatly reduced. Inasmuch as only the gross weight and not the cobalt content of imported ore is recorded, it is impossible accurately to estimate the magnitude of the decline. However, on the assumption that the average grade of the ore imported was 10 per cent, the indicated consumption, in terms of equivalent metal content of imported ore, metal, oxide, and miscellaneous compounds, dropped from about 1,200,000 pounds in 1929 to about 800,000 pounds in 1930. Import statistics for recent years follow:

Cobalt ore, cobalt, and oxide imported for consumption in the United States, 1921–1930

Year	Ore		Cobalt		Oxide		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1921	7, 657	$3, 235	38, 442	$105, 539	164, 003	$342, 426	210, 102	$451, 200
1922	5, 195	7, 075	126, 364	321, 396	217, 530	435, 895	[1] 349, 089	[1] 764, 366
1923	58, 719	56, 326	225, 639	552, 434	258, 574	511, 903	[1] 542, 932	[1] 1, 120, 663
1924	28, 786	37, 276	118, 952	264, 935	226, 703	440, 898	[1] 374, 441	[1] 743, 109
1925	34, 782	31, 320	198, 669	422, 185	287, 265	546, 292	[1] 520, 716	[1] 999, 797
1926	154, 468	55, 820	387, 076	820, 873	333, 132	632, 478	[1] [2] 874, 786	[1] [2] 1, 509, 211
1927	60, 382	3, 019	407, 198	841, 442	369, 747	703, 608	[1] 837, 327	[1] 1, 548, 069
1928	107, 498	25, 922	535, 817	1, 147, 574	364, 154	692, 753	[1] 1, 007, 469	[1] 1, 866, 249
1929	454, 443	51, 862	806, 640	1, 743, 465	475, 928	884, 873	[1] 1, 717, 011	[1] 2, 680, 200
1930	199, 642	18, 994	460, 251	984, 244	425, 881	769, 331	[1] 1, 085, 774	[1] 1, 772, 569

[1] Also 11 pounds of "other salts and compounds," valued at $26, imported Sept. 22 to Dec. 31, 1922. Not separately classified prior to change in tariff. Similar additional imports in 1923 were 45,644 pounds, valued at $27,356; in 1924, 797 pounds, $856; in 1925, 13,256 pounds, $7,894; in 1926, 37,342 pounds, $21,647; in 1927, 55,127 pounds, $28,681; in 1928, 68,281 pounds, $39,993; in 1929, 64,782 pounds, $37,548; and in 1930, 55,303 pounds, $24,121.

[2] Includes 110 pounds of zaffer, valued at $40, in 1926. No zaffer imported in 1921 to 1925 and 1927 to 1930.

Cobalt compounds imported for consumption in the United States, 1927–1930

	1927		1928		1929		1930	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Linoleate							91	$38
Sulphate	55, 045	$28, 617	68, 150	$39, 791	60, 596	$34, 893	33, 084	17, 564
Other salts	82	64	131	202	4, 186	2, 655	22, 128	6, 519
	55, 127	28, 681	68, 281	39, 993	64, 782	37, 548	55, 303	24, 121

Cobalt and cobalt ore imported into the United States, 1928–1930, by countries

[General imports]

Country	1928		1929		1930	
	Pounds	Value	Pounds	Value	Pounds	Value
Africa, British West	6, 832	$200				
Australia	88, 200	13, 822	209, 420	$33, 413	49, 034	$8, 173
Belgium	260, 900	611, 596	498, 749	1, 159, 426	368, 788	809, 156
Canada	217, 586	404, 370	499, 758	533, 087	216, 181	130, 628
Chile	6, 164	3, 897				
Germany	63, 633	139, 611	33, 156	69, 401	25, 890	55, 281
	643, 315	1, 173, 496	1, 241, 083	1, 795, 327	659, 893	1, 003, 238

Belgium has become the principal source of world supply of cobalt in various forms. It is noteworthy that in 1930 Belgium furnished 81 per cent of the value of the cobalt and cobalt ore imported into the United States as compared with 65 per cent in 1929 and 52 per cent in 1928. Moreover, the same country is the principal source of cobalt oxide, which is also imported in substantial quantity from Canada and to a smaller extent from Germany and Great Britain.

Cobalt production and prices are substantially controlled by agreement among Belgian, Canadian, and British operators. The Belgian output, as reported by the Union Minière du Haut Katanga, was about the same in 1930 as in 1929, amounting to 700 metric tons. The element is recovered as metal and in oxide and salts at the company's refinery at Oolen, Belgium, which treats chiefly an electric furnace alloy (containing about 30 per cent of cobalt and 30 per cent of copper, along with iron and other elements) smelted from ores and residues and obtained from the mines and smelters in the Belgian Congo. In Canada the cobalt content of Ontario silver ores was formerly not worth recovering but old mines have been reopened and ores that could not be worked for silver alone are now produced and sold. Because of the collapse in the price of silver and the gradual depletion of high-grade ores the output of cobalt purely as a by-product of silver mining has declined. According to Canadian Government opinion, however, the production of cobalt from low-silver ores can continue indefinitely at about the present (somewhat reduced) rate. In 1930, 29 mines were shipping from the Cobalt area; only four of these—Agaunico, Mining Corporation, O'Brien, and Nipissing—were operated by the owning companies; the remainder represented the activities of lessees.[4] The cobalt ores are in part exported as such and in part treated in Canada for the production of metal, alloys, and oxide or salts. In terms of cobalt metal content the Canadian output was 694,163 pounds in 1930 as compared with 929,415 pounds in 1929. The nickel-copper ores of the Sudbury district contain 0.1 per cent of cobalt. No statistics of production from this source are reported. An appreciable recovery is made at the Mond Nickel Co. refinery at Acton, England.

Throughout the year the price of black oxide (70 to 71 per cent cobalt) was held at $2.10 per pound, f.o.b. Deloro, Ontario. Spot quotations for 97 to 99 per cent rondelles held firm at $2.50. The London quotations were 8s. ($1.94) for black oxide, 8s. 10d. ($2.15) for gray oxide, and 10s. ($2.43) for metal. These prices are essentially the same as those quoted in 1929. Early in 1931, however, the Deloro Smelting & Refining Co., virtually the only consumer of cobalt ores in the Western Hemisphere, instituted a reduced buying schedule on ores. The new prices offered per pound of cobalt content are as follows:

Cobalt assaying 8 to 9 per cent, 40 cents per pound; 9 to 10 per cent, 42½ cents; 10 to 11 per cent, 45 cents; 11 to 12 per cent, 47½ cents; 12 to 13 per cent, 50 cents; 13 to 14 per cent, 52½ cents; 14 to 15 per cent, 55 cents.

Under the revised schedule, for example, an ore containing 8½ per cent of cobalt would be worth $68 a ton as compared with $90 under a former contract. In the case of higher-grade ores, however, the reduction is considerably less. A 14½ per cent ore, for example, is worth $159.50 a ton under the new rate as compared with $180 a ton under the old basis. Ores carrying over 200 ounces of silver are purchased under a different contract, the silver content as well as the cobalt being paid for.

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[4] Rogers, W. R., and Young, A. C., Preliminary Report on the Mineral Production of Ontario in 1930: Ontario Dept. Mines Bull. 76, 1931, p. 18.

NEW OCCURRENCES OF COBALT ORE

In its 1929 report, presented to the stockholders in July, 1930, the Union Minière announced that further deposits of cobaltic copper had been disclosed at Mindigi and Mirungwe about 70 kilometers from the Panda works. Assurance was also given that the requirements of the cobalt plants could easily be met for years. References to the mineralogy of the new Rhodesian copper deposits comment upon the presence of linnæite, the cobalt-nickel sulphide, and point out that this tends to link them genetically with the Katanga deposits. Geologists who have examined the new copper fields, however, have expressed the opinion that the cobalt content may be too small to affect materially the cobalt market even when the African mines come into full production; but this remains to be seen.

The Imperial Institute[5] has summarized discoveries of cobalt minerals since 1924 (none of which it deems of great economic importance), as follows:

Great Britain.—The nickel-cobalt mineral of Talnotry, Kirkcudbrightshire, Scotland, has been described by J. W. Gregory (Trans. Inst. Min. and Met., 1927, 37, 178-182). Traces of smaltite occur there with niccolite in granodiorite, and are considered by Gregory to be of secondary origin.

Union of South Africa.—Smaltite (cobalt arsenide) has recently been discovered at the gold mine on Waaikraal No. 206, in the Rustenburg district of the Transvaal, Union of South Africa. The ore occurs scattered in the upper part of the reef and also in the overlying magnetite band, and is accompanied by erythrite (cobalt hydrous arsenate). The ore is said to contain up to 1 per cent of cobalt. The reef has been explored for a distance of 450 feet along the strike, and the main shaft has been sunk about 160 feet on the incline.

A cobalt-gold ore has also been found on the farm Kruis River, in the Middleburg district of the Transvaal. The locality was worked for gold about fifty years ago. A trial shipment of 50 tons of ore has been sent to Europe for testing purposes.

In 1927, a discovery of cobalt and bismuth was reported to have been made near Jackalswater, Namaqualand, South Africa.

Canada.—Several discoveries of cobalt mineral have been made recently in Canada.

In 1925, cobalt was reported to have been discovered at Point Mamainse, Michipicoten district, Ontario. In 1928, cobalt minerals were found at Boulder Creek, Cowichan district, British Columbia, at Coleman Town, 2½ miles southeast of Cobalt, Temiskaming district, Ontario, which is being developed, and at Lynx Lake, 10 miles east of the Ontario-Manitoba boundary. In the northern part of Hart township, Sudbury district of Ontario, a cobalt mineral, probably ferruginous cobaltite (sulpharsenide), is found associated with magnetite, pyrite, chalcopyrite, galena and blende. The country-rock is limestone, metamorphosed by diabase-amphibolite. The occurrence has been described by F. Fitz Osborne.

Commonwealth of Australia.—The occurrence of cobalt ore in the Cloncurry field of Queensland was briefly referred to in the monograph. At Mount Cobalt mine, the main shaft is down to 229 feet, and the vein has been proved for about 1,000 feet in length. This property has been practically the only producer of cobalt in recent years. In 1926, 1,718 tons of ore raised produced 136 tons of concentrate, and 165 tons of rich ore were shipped—the output for that year being equivalent to 27 long tons of metal. There was no production in 1927, and in 1928 the output was a little under eight long tons (metal content). From 1921 to 1928, inclusive, Queensland produced 726 tons of cobalt, valued at £149,580.

The Queen Sally cobalt mine, Koolamarra, has been described by E. C. Saint-Smith, Queensland Govt. Min. Jnl., July 25, 1925, 281. Here the black oxide (asbolite), containing up to 28 per cent of cobalt, occurs in lenses with some smaltite in a calcite gangue. The country rock is fractured quartzite. The lode strikes N. W.-S. E., and dips N. E. 60°. In one shaft the ore is frequently disposed in "floors" in a highly disrupted quartz-schist.

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[5] Bulletin of the Imperial Institute (London), vol. 28, No. 2, July, 1930, pp. 190-195.

In 1925, a cobalt mineral was discovered on the dump of an old shaft at one time owned by the Mount Cuthbert Company, 7 miles south of Kajabbi, and also in the dump of a mine about 13 miles from Quamby.

In 1927, a prospect was reported on the Dugald River, 50 miles north of Cloncurry, and a lode showing 40 per cent of copper and about 17 per cent of cobalt was located at Loongana, 20 miles south of Cloncurry.

Europe.—The sulphidic arsenical nickel-copper ores of the Alpine deposits of Austria, Italy, and Switzerland have been described by G. Hiessleitner (Zeits. f. prakt. Geol. 1929, 37, 152–9), and a silver-copper-cobalt vein near Nieder-Ramstadt, in the Odenwald, Hessen-Baden, Germany, by G. Klemm, (Zeits. f. prakt. Geol. 1923, 41–3), and the possibility of the reopening of the cobalt ore mines in the Siegen district of Westphalia, Prussia, has been discussed by H. Quiring (Gluckauf, 1930, 66, 149–55).

In Spain, the old cobalt mines "Profunda" (province of León) and "Aramo" (in the Asturias) were reopened in 1928, and works for the electrolytic treatment of copper and cobalt were established at Villamanin (León) by Metallurgica del Cobre y del Cobalto, S. A.

Belgian Congo.—The occurrence of cobalt in some of the copper ores of Katanga, Belgian Congo, where production began in 1924, was only briefly referred to in the Institute monograph, and the following additional information will be of interest as that deposit is now the chief producer of cobalt ore.

The cobalt ore occurs associated with copper ores in the Étoile, Ruashi, and Luisha mines of the Union Minière du Haut Katanga. The Ruashi mine, 8 miles from Elizabethville, is the principal producer. A basin-shaped ore-body in altered dolomite is being worked to over 100 feet in depth. Ores rich in cobalt are distinguished by their black colour, due to cobalt oxide, and, after being sorted by hand, contain about 3 per cent of cobalt and are then concentrated. Ores, which, after hand-picking, contain more than 6 per cent of cobalt, are smelted directly. The cobaltic ore of the Étoile and Ruashi mines contains heterogenite (hydrated oxide of cobalt containing copper), a decomposition product of smaltite. It is intimately mixed with malachite and chrysocolla. In the Luisha mine the cobalt mineral is found partly as a black sandy material, and partly as a friable black ore. In depth the cobalt minerals have been identified as the sulphides linnaeite ($CoS.Co_2S_3$) and carrolite ($CuS.Co_2S_3$).

United States.—In Arizona, U. S. A., veins from 1 to 3 inches in width have been discovered recently, which are said to contain from about 29 to 49 per cent of cobalt. The veins are also said to carry bismuth, gold, aluminum and arsenic.

In 1930, cobaltiferous gesdorffite was identified in a pyrrhotite and pyrite deposit in Quebec which may yield by flotation nickel-cobalt-bearing concentrates of commercial value.[6] The Cornwall iron ores in Pennsylvania, now owned wholly by the Bethlehem Steel Corporation, contain cobalt in small amounts, but there is no record of the commercial recovery of cobalt from this source. In recent years the copper in these ores has been saved, but formerly both the copper and the cobalt were in the ore as it went to the iron blast furnaces and were either lost in the slag or included in the pig iron. Cobalt-bearing ores have been worked in various other localities in the United States, notably in southeast Missouri, but most of these operations have been short-lived. Recent discoveries in Arizona are being explored; in 1930 the Cobalt Gold Mining Co. of Denver, which was engaged in opening up a property in Boulder County, Colo., is said to have reported samples assaying 3 to 6 per cent of cobalt, with associated nickel, copper, and gold values.

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[6] Ellsworth, H. V., Nickel-Cobalt Minerals on Calumet Island, Quebec; Canadian Min. Jour., vol. 51, No. 37, Sept. 12, 1930, pp. 886–888.

WORLD PRODUCTION

The production of cobalt is reported for the several producing countries in such indefinite figures that the estimates are not very exact. From various official reports, however, the following data have been compiled:

World production of cobalt, 1928–1930, in metric tons

Country	Cobalt-bearing material	1928		1929		1930	
		Gross weight	Cobalt content	Gross weight	Cobalt content	Gross weight	Cobalt content
Australia: Queensland	Cobaltite concentrates, etc.	40	8	(1)	20	(1)	(1)
Belgian Congo	Copper-iron-cobalt alloy	(1)	[2] 450	(1)	[2] 700	(1)	[2] 700
Canada: Ontario	Cobalt, alloys, and chemicals	(1)	434	(1)	422	(1)	315
Chile	Arsenosulphide ore	11	2	------	------	------	------
China: Yunnan [3]	(1)	250	(1)	250	(1)	250	(1)
Germany: Saxony	Cobalt-bismuth-nickel ores	82	(1)	48	(1)	(1)	(1)
India, British: Burma [4]	Cobaltiferous nickel speiss	3,878	136	3,051	107	3,102	109
		--------	(1)	--------	(1)	--------	(1)

[1] Data not available.

[2] Cobalt in metal, oxide, and salts produced at Oolen, Belgium.

[3] Approximate production.

[4] Year ended June 30 of year stated.

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The following articles on cobalt are among those that appeared or became available during 1930:

BULLETIN OF THE IMPERIAL INSTITUTE (London). Recent developments in relation to cobalt. Vol. 28, No. 2, July, 1930, pp. 190–195.

A summary of recent advances in the metallurgy of cobalt and its industrial uses.

DRURY, C. W. The manufacture and uses of stellite. Canadian Min. and Met. Bull., No. 219, July, 1930, pp. 930–947.

FINK, COLIN G., AND LAH, KIHOUGH. The deposition of nickel-cobalt alloys. Trans. Am. Electrochem. Soc., vol. 58 (preprint), 1930, 9 pp. Chem. Abs., vol. 24, 1930, pp. 4989–4990.

The co-deposition of cobalt and nickel from the sulphate-chloride bath was investigated. A silver-white deposit can be obtained within the wide range of 55 to 75 per cent nickel and 45 to 25 per cent cobalt. Cobalt dissolves anodically more readily than nickel in the sulphate-chloride bath, and also deposits cathodically more readily than nickel. Increasing the total metal concentration of the bath increases the cobalt content of the plate. Increasing the temperature of the bath, decreasing the acidity or increasing the cathode current density likewise increases the cobalt content of the plate. The white alloy plate is more than three times as hard as nickel and decidedly more resistant to corrosion than nickel. It is whiter than silver which has been exposed to city atmosphere more than 2 hours.

GERMUTH, FREDERICK G. A study of the various methods for the separation and estimation of nickel and cobalt salts. Chem. Anal., vol. 19, March, 1930, pp. 4–10.

GLASSTONE, S., AND SPEAKMAN, J. C. The electrodeposition of cobalt-nickel alloys. Trans. Faraday Soc., vol. 26, 1930, pp. 565–574.

HEIM, OSCAR. Determination of cobalt in driers, japans, and alloys. Ind. and Eng. Chem., Anal. Ed., vol. 2, Jan. 15, 1930, p. 38. Metals and Alloys, vol. 1, July, 1930, p. 634.

The method of Vogel, made quantitative, is described and has been tested. Cobalt up to about 20 per cent has been determined satisfactorily.

JOURNAL DU FOUR ELECTRIQUE. Making cobalt in an electric furnace. Vol. 39, August, 1930, p. 288. Metals and Alloys, vol. 2, April, 1931, p. 90.

Three electric furnaces at Panda (Belgian Congo) melt either ore concentrates containing iron, copper, and cobalt or cobalt rich slag of copper smelting water jackets. Practically complete recovery of copper and cobalt is obtained. The alloy is shipped to Oolen (Belgium) and is separated there. 708 tons of cobalt were produced in 1929.

KERSHAW, H. E. Cobalt magnet steels. Edgar Allen News, vol. 9, September, 1930, pp. 701–705. Metals and Alloys, vol. 2, March, 1931, p. 63.

There are two classes of cobalt magnet steels: the low and medium cobalt chrome steels and the high cobalt steels. The cobalt chrome steels are sub-divided: one containing 9 per cent and the other 16 per

cent cobalt, but both containing 9–10 per cent chromium, 1.5 molybdenum and 1.0–1.15 per cent carbon; these are air-hardening and the best results follow a triple heat treatment. The high cobalt steel usually has 36 per cent cobalt, with about 6 per cent chromium, 4–6 per cent tungsten, and 0.9 per cent carbon; these are oil-hardening; only a single treatment is necessary, but accurate temperature control is essential. This alloy has better magnetic properties than any other known at present; B–H maximum values of 900,000–1,000,000 are regularly obtained. The high frequency electric crucible furnace is very efficient for the manufacture of cobalt magnet steels; can also be used for cast magnets. With cobalt-chromium steels better magnetic results are obtained from forged than from cast magnets; the higher the cobalt content, the greater the discrepancy between the magnetic results. With the 36 per cent cobalt alloy, cast magnets can be produced having as good, sometimes better, magnetic properties than forged. Some special magnets are described.

LENANDER, N. (TO ORKLA GRUBE A. B. LODDEN, NORWAY). Cobalt metallurgy. U. S. Patent 1,783,046, Nov. 25, 1930. Eng. and Min. World, vol. 2, January 1931, p. 50.

Separation of cobalt from iron in a leach solution by oxidizing the iron with an alkali metal chlorate and precipitating the ferric iron thus obtained, leaving the cobalt in solution for special treatment.

LIEBERSON, A. Detection and estimation of cobalt in presence of nickel. Jour. Am. Chem. Soc., vol. 52, 1930, pp. 464–5.

LUM, E. A. A delicate reagent for cobalt. Chem. News (London), vol. 141, Aug. 29, 1930, p. 140.

RHODES, F. H., AND HOSKING, H. J. Separation of nickel and cobalt by means of hypochlorite. Ind. and Eng. Chem., Anal. Ed., vol. 2, Apr. 15, 1930, pp. 164–166.

SCHUSTER, G. New method of qualitative and quantitative separation of cobalt and nickel. Jour. Pharm. Chim., vol. 11, 1930, pp. 97–101. Chem. Abs., vol. 24, Sept. 20, 1930, p. 4478.

MOLYBDENUM

DOMESTIC PRODUCTION

The production of molybdenum ore in the United States during 1930, although slightly less than in 1929, was substantially greater than in 1928 or any preceding year.

The production at the mines in 1930, as reported by domestic producers, amounted to 3,618 short tons of concentrates containing 6,205,000 pounds (average 85.75 per cent) of molybdenum sulphide, MoS_2. The shipments of concentrates from the mines contained an equivalent of 3,759,269 pounds of elemental molybdenum valued, more or less arbitrarily, at $2,068,000.

In 1930, as in recent years, the Climax Molybdenum Co. and the Molybdenum Corporation of America were the principal producers, and both companies enlarged their capacities for production. The Climax Molybdenum Co. at Climax, Lake County, Colo., maintained its position as the largest producer of molybdenum in the world. With the completion in November of its new crushing plant it increased its potential crushing capacity to 7,200 tons of raw ore in 24 hours; with its present mills it can produce 6,000,000 to 8,000,000 pounds of the element annually—practically twice as much as the world has hitherto consumed in a single year. The new Phillipson tunnel, 465 feet below and about 700 to 1,300 feet north of the White tunnel, the next immediate upper working level, was continued through the Mosquito fault and at 2,900 feet a right angle (south) drift early in 1931 crosscut a new segment of the mineralized area of equal or better grade ore than that developed above the White tunnel. The Phillipson tunnel, when continued eastward, is expected to cut similar ore determined by diamond drilling. The ore body is ring shaped in plan, the inside diameter apparently increasing with depth.

In April, 1930, the Molybdenum Corporation of America acquired the ferro-alloy and chemical plant and business of the York Metal & Alloys Co. and subsequently produced "molyte" and ferromolybdenum at its plant in Washington, Pa., and calcium molybdate, ammonium molybdate, sodium molybdate, molybdic oxide, and other chemicals at York, Pa. The capacity of the mine was increased by development and the capacity of the mill of this company in Taos County, N. Mex., between Red River and Questa, was practically doubled as a result in part of the installation of a new power plant and the addition of new flotation machines.

Molybdenum prospects near Pitkin, Gunnison County, Colo., were investigated by the Stone & Davis Corporation, and prospecting was carried on by the Silver Queen Mining Co. in Custer County, Colo., near Rye. New prospects were reported in Nevada and in Alaska (near Wrangell).

Data on the production of molybdenum in the United States during the past 10 years are given in the following table:

Molybdenum in ore and concentrates, produced in the United States, sold in 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1923	22,667	(2)	1927	2,286,075	$1,858,786
1924	297,174	(2)	1928	3,329,214	1,924,600
1925	1,154,050	[3] $961,324	1929	3,904,648	[3] 2,259,000
1926	1,431,830	1,192,714	1930	3,759,269	[3] 2,068,000

[1] No sales reported for 1921 and 1922. [2] Value not reported. [3] Estimate by Bureau of Mines.

PRICES

The price of calcium molybdate or "molyte" was reduced in October from 95 to 85 cents per pound of contained molybdenum. Ferromolybdenum was quoted throughout the year at $1 per pound of contained molybdenum. Molybdenum is marketed principally in the form of calcium molybdate or "molyte," and to a minor extent as the ferro-alloy. There is also a small sale of molybdenite concentrates, but in the United States this business is usually confined to relatively small lots purchased by chemical firms. According to the Engineering and Mining Journal, nominal quotations for molybdenum ore ranged from 50 to 55 cents per pound of contained MoS_2 in July to 35 to 40 cents at the end of the year. American molybdenite was quoted in the London market at 35s. 6d. per long-ton unit (22.4 lbs.) c. i. f., for contract quantities; Australian ore was quoted at 30s. and Canadian was offered at even less.

IMPORTS AND EXPORTS

In 1930, as in 1929 and 1928, no molybdenum ore was imported into the United States; from 1921 to 1927 imports were as follows:

"Molybdenum ore [1] *(steel-hardening)" imported for consumption in the United States, 1921–1930* [2]

Year	Pounds	Value	Year	Pounds	Value
1921	29,783	$20,471	1925 [3]	1,954	$1,793
1922	412,221	90,015	1926 [3]	13,397	11,175
1923 [3]	16,671	13,115	1927 [3]	12,541	10,472
1924 [3]	10,379	9,038			

[1] 1921–1922, recorded as molybdenum ore; 1923–1930, recorded as molybdenum content of ore.

[2] No imports reported for 1928, 1929, and 1930.

[3] Classification under tariff of Sept. 22, 1922, "Molybdenum ore and concentrates (molybdenum content)."

Figures on exports of molybdenum are not separately recorded by the Bureau of Foreign and Domestic Commerce.

WORLD PRODUCTION

The United States is the principal producer of molybdenum and furnishes more than 85 per cent of the world's supply of ore; the remainder comes chiefly from Norway, with smaller shipments from Australia and Canada. The accompanying table shows the world production of molybdenum in 1929 and such data as are obtainable for 1930. The table has been compiled from available official reports.

World production of molybdenum ores and concentrates, 1929 and 1930

Country [1]	Mineral	Ore	Concentrates	Per cent MoS_2	Contained molybdenum	Value
1929		*Metric tons*	*Metric tons*		*Metric tons*	
Australia: New South Wales	Molybdenite	(2)	0.6	(2)	(2)	$223
Austria	Wulfenite	(2)	(2)	(2)	2.6	(2)
Canada	Molybdenite	(2)	15	85	7.7	(2)
Chosen	do	(2)	30	(2)	(2)	15,642
Morocco, French [3]	do	(2)	.7	(2)	(2)	509
Norway	do	(2)	228	75–80	106	188,113
United States [4]	do	380,471	3,496	75.40–88.33	1,824	2,321,000
1930						
Australia: New South Wales	Molybdenite	(2)	3	(2)	(2)	2,115
Austria	Wulfenite	(2)	(2)	(2)	.2	(2)
Chosen	Molybdenite	(2)	26	(2)	(2)	14,313
Morocco, French	do	(2)	.8	(2)	(2)	(2)
Norway	do	(2)	284	75	128	227,993
United States	do	387,139	3,282	85.75	1,688	2,048,000

[1] In addition to the countries listed Mexico is a producer of molybdenite, but data of output are not available for the years under discussion.
[2] Data not available.
[3] Exports.
[4] In addition to the ore milled, a small quantity of ore, averaging 16 per cent MoS_2, was sold crude.

Canada.—Development work was discontinued by the Dalhousie Mining Co. at its molybdenite property on Alice Arm, British Columbia. Early in the year the Superior Alloys (Ltd.) undertook the production of calcium molybdate at its plant at Sault Ste. Marie, Ontario.

Norway.—During 1930 the Knaben Molybdaengruber A/S was the only mine at work. It is reported to have produced 284 metric tons of molybdenite, as compared with 227 tons in 1929.[7]

Russia.—The discovery of new deposits of molybdenum ore was reported near the glacier Tuskupruktai in Kazakstan.[8]

USES

The actual consumption of molybdenum was substantially larger during 1930 than during any previous year except 1929. As by far the bulk of the production was used in steel manufacture and as the production of steel dropped 28 per cent in 1930 it is evident that the production of molybdenum-treated steels increased in relation to the total production of plain carbon and other alloy steels. Molybdenum is used extensively in aircraft and automotive steels. To a smaller extent it is used for various purposes in special steels employed in bearings, steel castings, and corrosion and high-temperature resisting alloys. A substantial outlet has recently been developed in the nickel-molybdenum-iron alloys, containing as much as 20 per cent molybdenum, which are capable of resisting the action of hydrochloric acid. A growing and important use in cast iron is also reported. The radio industry absorbs a surprising amount of molybdenum wire and sheet. Molybdenum wire, which is made by at least three companies, is used as the supporting filament in incandescent lamps and radio tubes. In the chemical field a new development of importance is the use of various catalysts, several of which contain molybdenum oxide, in connection with the hydrogenation of oils and especially in the production of motor fuel from the heavier constitutents of crude petroleum.

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[7] Norges Bergverksdrift, 1930, Oslo, 1931, p. 12.
[8] Mining Journal (London), Molybdenum Deposits in Kazakstan· Vol 171, Dec. 13, 1930, p. 980.

In an effort to determine whether satisfactory tools can be made without tungsten the War Department made a number of tests with commercial high-speed tools as well as molybdenum high-speed steels. The results are reported in a paper by Capt. S. B. Ritchie,[9] who states that: (*a*) Molybdenum can be substituted in whole or in part for tungsten in high-speed tools, and (*b*) there are no difficulties of manufacture of molybdenum high-speed tools in quantity that can not be met easily.

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History of discovery; mode of occurrence; uses; price from 1922 to 1929; geographical location of deposits; statistics; bibliography.

Cass, W. G. Molybdenum and its compounds. Ind. Chem. vol. 5, October, 1929, pp. 429–431. Metals and Alloys, vol. 1, June, 1930, p. 563.

A brief description of the mineralogy, technology, and chemistry of molybdenum is given.

Cazaud, R. Molybdenum. Aciers spéciaux, Métaux et Alliages, vol. 4, September, 1929, pp. 413–416; October, 1929, pp. 465–469; November, 1929, pp. 518–524; December, 1929, pp. 590–597. Metals and Alloys, vol. 1, December, 1930, p. 899.

A review of the general properties of molybdenum steel. The author discusses the use of special molybdenum steels in airplane construction and gives a bibliography. He also deals with its use in automotive work, railways, and machine construction. An analysis is given.

Climax Molybdenum Co. Mo-lyb-den-um in 1930. 104 pp.

Abstracts of articles relating to the use of molybdenum that appeared in technical journals during 1930.

——— Calcium molybdate. 46 pp.

The characteristics of calcium molybdate, its manufacture, sampling, packing, analysis, and effects of variation in analyses are discussed and a method is given for the determination of molybdenum. The alloying of steel with molybdenum, the recovery from calcium molybdate, its limitations and melting practice in the basic and acid open-hearth processes, basic and acid electric, bessemer, crucible, and cupola furnaces are discussed. An appendix discusses molybdic oxide and molybdenum sulphide.

Doerner, H. A. Notes on the determination of molybdenum. Inf. Circ. 6335, Bureau of Mines, September, 1930, 3 pp.

Fulop, Jean. Le molybdène. Mines Carrières, No. 98, December, 1930, pp. 173–176.

Discusses uses, sources of supply, markets, and prices.

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[9] Ritchie, S. B., Molybdenum in High-Speed Steel. Army Ordnance, vol. 11, July-August, 1930, pp. 12–19.

Hardy, Thomas W. Calcium molybdate, iron and steel making. Blast Furnace and Steel Plant, vol. 18, April, 1930, pp. 613–617; May, 1930, pp. 784–788, 795.

Outlines the history and occurrence of molybdenum, its effect on the properties of steel, its early applications to ferrous metallurgy, the use of the ferro-alloy as an addition agent and particularly the development of $CaMoO_4$ as an alloying agent.

Kruttschnitt, J. Molybdenum, tungsten, vanadium. Mineral resources of the Southwest. Min. Cong. Jour., vol. 16, October, 1930, pp. 741–743.

Mabee, H. C. Manufacture and use of calcium molybdate. Canadian Dept. Mines, Ore Invest., 1928, pp. 156–158. Chem. and Ind., vol. 49, Dec. 19, 1930, p. 1149.

Calcium molybdate for use in steel manufacture is readily prepared by roasting molybdenite at 600° until free from sulphur, and then heating the resulting molybdenum trioxide at 600° with finely-powdered calcium carbonate.

Malowan, S. L. Molybdenum and its engineering applications. Chem. Ztg., vol. 54, Nov. 19, 1930. Eng. and Min. World, vol. 2, February, 1931, p. 112.

Location of molybdenum deposits; methods of extraction from ore; production of pure molybdenum; molybdenum is used metallurgically only in combination with iron or calcium; uses of molybdenum steel.

Merrill, J. L., and Russell, A. S. Electrolytic deposition of molybdenum at a mercury cathode. Jour. Chem. Soc., London, October, 1929, pp. 2389–2393.

Ritchie, S. B. Molybdenum in high-speed steel. Army Ordnance, vol. 11, July-August, 1930, pp. 12–19.

Siemens & Halske A.-G. Vacuum discharge tubes. French Patent 685,902, Dec. 2, 1929. Chem. Abs., vol. 24, Nov. 20, 1930, p. 5543.

In discharge tubes of high vacuum the cathodes are made of an alloy of metal of high fusion point such as molybdenum with thorium.

Smith, J. Kent. Molybdenum improves gray iron. Foundry, vol. 58, 1930, pp. 54–55. Chem. Abs., vol. 24, Sept. 20, 1930, p. 4494.

Results are given of physical tests on automotive gray iron castings with varying molybdenum content.

Thum, E. E. Molybdenum steels gaining favor. Iron Age, Jan. 9, 1930, vol. 125, pp. 141–144, 201–202. Metals and Alloys, vol. 1, May, 1930, p. 528.

High-molybdenum alloys have been made commercially by the crucible process many years ago. The first electric furnace heat of low-molybdenum steel was made in December, 1927, while open-hearth production started in May, 1918. Both events took place at the United Alloy Steel Corporation, Canton, Ohio. Effect of adding molybdenum to alloy steels is: (1) Its ability to induce air hardening and hardening at depth; (2) Quenched alloy steels with molybdenum hold their hardness after higher drawing temperatures. Free from "temper brittleness" which occasionally affects chromium and chromium-nickel steels; (3) Molybdenum forms solid solutions with iron and widens temperature range for hot working and heat treating; (4) Steels with 0.3 per cent of molybdenum roll and drop-forge well; (5) It cold works well; (6) Chromium steels with molybdenum machine more easily than nickel-chromium steels without it; (7) Principal effect on tensile properties of alloy steels is to increase the per cent reduction of area; (8) Has no specific influence in resisting repeated or alternating stresses. Lists some of the important uses and tabulates the chemical and physical properties of the various alloy steels containing molybdenum, and based on S. A. E. specifications.

Trofimov, V. S. Molybdenum deposits of Gootaysky district. Mineral'noe Suir'e i Tzvetnuie Met., vol. 4, 1929, pp. 1122–1130. Chem. Abs., vol. 24, Nov. 20, 1930, p. 5676.

Molybdenite is always accompanied by quartz veins, and 22 of these occurrences have been found in the district. The concentration of ore is effected by passing it through a ball mill, with subsequent sifting.

Werz, W. Determination of molybdenum in steels and in ferromolybdenum. Ztschr. anal. Chem., vol. 80, 1930, pp. 109–112 Chem. and Ind., vol. 49, May 23, 1930, p. 463.

The steel (3–5 g.) is dissolved in 40 c. c. of hydrochloric acid; the solution evaporated to dryness, and the residue heated at 130°, cooled, and dissolved in 30 c. c. of hydrochloric acid and 10 c. c. of 1:1 nitric acid. After filtering to remove silica, the solution is evaporated to expel most of the acid, diluted with hot water, and poured into a boiling solution of 70 g. of sodium hydroxide in 300 c. c. of water. The mixture is cooled, diluted to 750 c. c., and 600 c. c. of this solution are filtered through a dry paper, rendered just acid to methyl-orange by addition of nitric acid, heated to boiling, and treated with 10–15 c. c. of 10 per cent lead nitrate solution. The precipitate of lead molybdate is collected in a glass filter-crucible, washed with hot water, dried at 200–300°, and weighed. If the steel contains tungsten, 3–5 g. are dissolved in hydrochloric acid, the solution is oxidized with nitric acid, evaporated, diluted, and poured into an excess of hot sodium hydroxide solution. An aliquot part of the alkaline liquor is filtered, made just acid with sulphuric acid, and boiled with an excess of ammonia. The precipitate is removed and the solution boiled with 20 c. c. of 30 per cent tartaric acid, ammonia to alkalinity, and 50 c. c. of freshly prepared ammonium sulphide solution; acidification with 50 c. c. of 1:1 sulphuric acid effects precipitation of molybdenum sulphide free from tungsten. The sulphide is collected, washed, and converted into trioxide for weighing. Ferromolybdenum is analyzed by the first of the above methods after decomposition by fusion with peroxide.

TANTALUM

GENERAL CONDITIONS

Tantalum is deemed less abundant in the earth's crust than gold and is much more difficult to recover from its ores. It sells, nevertheless, for about one-seventh the price of gold. In the form of bar and heavy sheet, chemically pure tantalum was quoted early in 1930 at $160 a kilogram; in March the price was reduced to $128, and the close of the year witnessed a further cut to $91. Tantalum powder is substantially cheaper; it was quoted during much of the year at $69.35 a kilogram.

Tantalum ore was worth nominally around 65 to 75 cents a pound of Ta_2O_5 content; foreign offerings were made late in 1930 at the equivalent of 40 cents, on the basis of 60 per cent ore. High-grade ores containing 70 per cent Ta_2O_5 or more were worth in small lots around $2.50 a pound of Ta_2O_5 content; a limited demand existed for columbite containing as little as 22 per cent of combined Ta_2O_5 and Cb_2O_5 at prices of 20 to 30 cents a pound gross weight. Such low-grade material has hitherto been almost unsalable.

Australia is the leading source of tantalum ores and in fact the bulk of the world's supply has come from the Pilbarra field in Western Australia. Smaller amounts have come from alluvial workings in the neighborhood of the old Mount Finnis tin claims in Northern Australia, and early in 1930 it was locally reported that as much as 790 tons of tantalite were available in this area, making it the largest known deposit in the world. It was estimated that the average yield over an area of 60 acres was "2 ounces to the dish, equal to £10 per yard."[10] In 1929 this area, after being idle for many years, produced less than 2 tons of tantalite. At latest reports the property, known as Gitsham and Johnston's tin and tantalite property on Flinders River, had been taken over on a 4-month option by the Mutooroo Copper Co., of Adelaide. The annual report of the Western Australia Department of Mines (Chemical Branch) for 1929 notes a number of tantalite samples received for examination. In addition to the area northwest of Greenbushes where a little commercial ore had previously been shipped, samples of salable ore (68 per cent Ta_2O_5) were reported as coming from the neighborhood of Collier Bay in the Kimberley district. From Gibraltar, where only columbite had previously been found, samples containing up to 60 per cent Ta_2O_5 were received.[11]

Offerings of tantalite from South Africa or Rhodesia have been made in the last year or two, but little is known as to the extent of the operations.

A new tantalite discovery in southeastern Manitoba was being investigated in 1930.[12] Tantalite, columbite, and euxenite have previously been reported elsewhere in Canada, notably in pegmatite dikes in Renfrew, North Hastings, and Frontenac Counties in Ontario, but only in comparatively small quantities.

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[10] Queensland Government Mining Journal, Tantalite in Northern Territory. Vol. 31, No. 357, Feb. 15, 1930, p. 43.

[11] Chemical Engineering and Mining Review (Melbourne), vol. 22, Sept. 5, 1930, p. 450.

[12] Canadian Mining Journal, Tantalite Reported: Vol. 51, Mar. 28, 1930, p. 306.

DOMESTIC PRODUCTION

The production of columbite in the United States, most of which is exported, reached a maximum of 17 short tons in 1928 and amounted to 11 tons in 1929. In 1930 it dropped to less than 3 tons, mined by Collingwood & Greene (near Pringle) and A. T. Roos (near Rapid City) in the Black Hills of South Dakota and Philip S. Hoyt in New Mexico.

The production of tantalum minerals in the United States (all from South Dakota prior to 1930) during the past 10 years is shown in the following table:

Columbite, mined in the United States, shipped in 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	3, 400	$1, 150	1927	1, 100	$378
1922	600	240	1928	34, 899	26, 332
1923	1, 350	540	1929	22, 117	17, 261
1924	1, 197	598	1930	5, 100	3, 350
1926	2, 100	650			

[1] No shipments reported for 1925.

IMPORTS

The bulk of the domestic supply of tantalum has been imported as ore. Imports for consumption since 1921 are shown in the following table:

Tantalum ores imported into the United States, 1921–1930 [1]

Year	Pounds	Value	Year	Pounds	Value
1921	[2] 1, 229	$788	1926	[4] 350	$149
	[3] 6, 785	1, 327	1927	[4] 15, 119	20, 012
1923	[4] 5, 600	3, 031	1929	[4] 15, 250	19, 418
1925	[4] 5, 022	1, 347	1930	[4] 8, 474	7, 036

[1] No imports reported for 1922, 1924, and 1928.
[2] Classified as "Ferro-alloys (tantalum)."
[3] Classified as "Steel-hardening ores (tantalum)."
[4] Classified as "Ores of ferro-alloying metals (tantalum)."

USES

In 1930 the Fansteel Products Co., of North Chicago, Ill., the leading producer of the metal, began to place upon the market an exceedingly hard, new cutting material under the trade name of "Ramet." This new product is essentially tantalum carbide combined with nickel, and the process of manufacture is similar to that of tungsten carbide tools. Tantalum metal powder is converted into carbide, ground fine in a ball mill with the addition of a suitable amount of nickel, pressed into molds, and then heat-treated. The blanks are then brazed to steel shanks and the tools ground to the desired shape. Tantalum carbide is not easily "wet" by other metals. This is a distinct advantage to the user inasmuch as it minimizes pitting due to hot chips alloying with the cutting material at the edge of the tool. Before "Ramet" can be brazed it has to receive a special heat treatment followed by nickel plating, after which it is readily joined to the steel shank. The producer calls special attention also to the high melting point (4,400° C.) and the low thermal conductivity of the material. As little heat is carried away from the work, the metal does not tend to get hot enough to weaken the joint even when zinc is used as the brazing material. Ramet-tipped tools have been used for cutting bakelite and nonferrous metals as well as chilled cast iron and the harder and tougher alloy steels. It can be employed for both rough and finish cutting, and it is also used for wire-drawing dies.

In the manufacture of vacuum tubes tantalum is employed in considerable quantities as a scavenger of residual gases; at low red heat it has remarkable absorptive powers for oxygen, nitrogen, and hydrogen. In laboratories tantalum utensils are used instead of platinum (which, despite its recent fall in price, is still many times more expensive). In chemical process industries the corrosion-resisting properties of the metal recommend it for consideration for all except high-temperature work (over 600° F.). Its ability to withstand wet chlorine is especially noteworthy; in fact, hydrofluoric acid and hot concentrated caustic are about the only reagents that do attack tantalum. The field of use in chemical plants has been widened greatly as a result of methods devised for fabricating equipment using only a thin coating of tantalum. In this manner the corrosion-resisting properties of tantalum are fully realized, while the necessary mechanical strength is supplied by a cheaper metal. By a new process developed in the Fansteel laboratories piping and fabricated parts are reinforced by electroplating with a layer of copper. Tantalum-lined copper tubing may be bent or coiled without cracking or destroying the bond between the two metals. Other uses include sundry electrolytic devices and spinnerets for the rayon industry.

BIBLIOGRAPHY

The following articles on tantalum, to which is appended a list of recent patents, are among those that appeared or became available during 1930:

Andrieux, L. The preparation and properties of the borides of tantalum and columbium. Compt. Rend., Dec. 30, 1929, pp. 1279–1281. (In French.)

Austin, M. M. Working properties of tantalum. Am. Inst. Min. and Met. Eng., Tech. Pub. 278, February, 1930, 8 pp. Metals and Alloys, vol. 1, No. 12, June, 1930, p. 563:

A bar of pure tantalum can be cold rolled without annealing from 0.4″ to 0.001″. When it is necessary to soften during working the metal can be annealed at 500° C., but a thorough anneal requires a temperature of 800 or 1000° C. The properties of the metal change as it is contaminated with gases. Samples that have had a prolonged heating in a vacuum tube have the hardness of annealed copper, and the usual commercial metal has the hardness of annealed mild steel. Examples of deformation of coarse grained metal are shown.

Fink, Colin G., and Jenness, Leslie G. Extraction of tantalum and columbium from their ores. Am. Inst. Min. and Met. Eng., Tech. Pub. 379, February, 1931, 18 pp. Min. and Met., vol. 12, January, 1931, p. 26.

The present methods of extracting the oxides of tantalum and columbium from the ore, involving fusion processes, are tedious and poorly adapted to commercial operation. Although common leaching agents have no effect on tantalum-columbium ores, a new leaching solution has been discovered and a method of leaching developed. It was recognized that the solution must be capable of decomposing the ore as well as acting as a solvent for tantalum and columbium. The authors knew that hydrofluoric acid attacks tantalum-columbium ores, and that tantalum and columbium oxides are soluble in hydrofluoric acid and carboxylic acids. By investigation they discovered that hydrofluoric acid would decompose the ore much more readily in the presence of a carboxylic acid and that a leaching solution composed of hydrofluoric acid and oxalic acid was far more effective than a solution of either acid used singly. It was then found that fluorspar, sulphuric acid and oxalic acid could be used efficiently, and the investigation was extended to determine the optimum concentration of these reagents and conditions for leaching. Tantalite, columbite, and samarskite ores were investigated. There is little difference between the action on tantalite and columbite. Samarskite is more readily leached than the other two, and this method has a great advantage over other methods applied to samarskite because it leaves the rare earth metals in the gangue. The method of recovering the tantalum and columbium from the solution after leaching was also investigated.

A large portion of the tantalum can be recovered in the form of the double fluoride of potassium and tantalum. Both metals can be recovered as their oxides by fractional precipitation with ammonia, compounds of these metals precipitating while the solution is still acid.

Grosse, Aristid D. The analytical chemistry of element 91, ekatantalum, and its difference from tantalum. Jour. Am. Chem. Soc., vol. 52, May, 1930, pp. 1742–1747.

The unsuccessful attempts to isolate and obtain element 91—ekatantalum—were based on the assumption that it resembles its lower homolog—tantalum—just as radium resembles barium. The origin and development of this assumption and its contradiction to conclusions derived from the periodic law are discussed. A study of the analytical chemistry of ekatantalum has been made with adequate amounts of its pure oxide. Its difference from tantalum, predicted by the author on the basis of Mendelejeff's law, has been proved experimentally. The behavior of ekatantalum toward different reagents is, in most of the cases observed, opposite to that of tantalum. Ekatantalum pentoxide (Et_2O_5) is a distinctly, though feebly, basic oxide without acidic properties, whereas tantalum pentoxide (Ta_2O_5) is an acid anhydride and readily forms stable salts with basic oxides.

Grove-Palmer, Frederick. Tantalum. Sheet Metal Ind., vol. 4, December, 1930, pp. 669–670. Metals and Alloys, vol. 2, March, 1931, p. 62.

The properties of the metal are set forth and possibilities of uses suggested, e. g., "diamond" drills, because of the hardness developed by the addition of a small percentage of carbon.

Krishnaswami, Kolar Ramakrishnaiyer. A revision of the atomic weight of tantalum. Determination of the ratios $TaBr_5$:5Ag:5AgBr and $TaCl_5$:5Ag:5AgCl. Jour. Chem. Soc., 1930, pp. 1277–1293. Chem. Abs., vol. 24, Oct. 20, 1930, p. 4967.

Calculations from the ratios of $TaBr_5$:5Ag:5AgBr and $TaCl_5$:5Ag:5AgCl give the atomic weight of Ta=181.36 (average of 24 determinations). Ta (99.2 per cent Ta, 0.8 per cent Ta oxides) is prepared by the Berzelius-Rose method (Pogg. Ann., vol. 99, 1856, p. 60), and from this, $TaBr_5$ and $TaCl_5$ are prepared by direct union with Br_2 and Cl_2 at 655–700° in an A atmosphere. The halides are purified by distillation and sublimation in a vacuum, and collected in an evacuated sampling bulb and sealed for analysis (both nephelometrically and gravimetrically by the Richards-Hönigschmid method). The tantalum preparations are tested spectroscopically, but no impurities could be found (with the possible exception of 0.05 per cent Si, Mg and Ca).

Peirce, D. D., and Yntema, L. F. Electrometric studies of the precipitation of columbium and tantalum and of molybdenum and tungsten. Jour. Phys. Chem., vol. 34, 1930, pp. 1822–1825.

Schoeller, W. R., and others. Investigations into the analytical chemistry of tantalum, niobium, and their mineral associates. Analyst, Cambridge, England.

I. Use of tartaric acid in the analysis of natural tantalo-columbates. Vol. 47, 1922, p. 93.
II. Separation of zirconium from tantalum and from columbium. Vol. 47, 1922, p. 93.
III. The volumetric estimation of columbium. Vol. 49, 1924, pp. 215–220.
IV. A new method for the separation of tantalum from niobium. Vol. 50, 1925, pp. 485–494.
V. The detection and determination of tantalum in niobium compounds. Vol. 50, 1925, pp. 494–497.
VI. The precipitation of the earth acids by sodium compounds. Vol. 51, 1926, pp. 613–620.
VII. The precipitation of tungsten acid by tannin. Vol. 52, 1927, pp. 504–514.
VIII. The separation of tungsten from tantalum and columbium. Vol. 52, 1927, pp. 504–514.
IX. Separation of titanium from tantalum and niobium. Vol. 52, 1927, pp. 625–637.
X. The separation of silica from the earth acids. Vol. 53, 1928, pp. 258–264.
XI. The precipitation of titanium by tannin. Vol. 53, 1928, pp. 264–267.
XII. Observations on the pyrosulphate-hydrolysis method. Vol. 53, 1928, pp. 467–475.
XIII. A new method for the separation of zirconium and hafnium from tantalum and niobium. Vol. 53, 1928, pp. 515–520.
XIV. A new method for the separation of small quantities of tantalum from columbium and from titanium. Vol. 54, 1929, pp. 320–326.
XV. A new method for the separation of tantalum and columbium from titanium and zirconium. Vol. 54, 1929, pp. 453–460.
XVI. Observations on tartaric hydrolysis. Vol. 54, 1929, pp. 704–709.
XVII. The quantitative precipitation of the earth acids and certain other oxides from tartrate solution. Vol. 54, 1929, pp. 709–715.
XVIII. A new method for the separation of titanium, zirconium and hafnium. Vol. 55, 1930, pp. 605–612.

SEARS, GEORGE W. Progress in production and use of tantalum. Am. Metal Market, vol. 37, Feb. 21, 1930, p. 5. Metals and Alloys, vol. 1, April, 1930, p. 171.

Tantalum is receiving increasing attention as an acid-resistant metal. Tantalum ores and production and some alloys are briefly discussed. The extraction and metallurgy of tantalum and of columbium are touched upon.

SWOBODA, K., AND HORNY, R. Determination of tantalum, tungsten, vanadium, and molybdenum in high-speed steel. Ztschr. anal. Chem., vol. 80, 1930, pp. 271–288. Chem. Abs., vol. 24, Aug. 20, 1930, p. 3966.

WAYLAND, E. G., AND SPENCER, L. J. Bismuto-tantalite, a new mineral, from Uganda. Mineralog. Mag., vol. 22, 1929, pp. 185–192. Chem. Abs., vol. 24, 1930, p. 1321.

The mineral is found at Gamba Hill, Busiro County, in pegmatite. It contains about 50 per cent Bi_2O_3 and 47 per cent $Ta_2O_5+Cb_2O_5$. The indicated formula is $Bi_2O_3.(Ta,Cb)_2O_5$. Crystallographic data and a complete chemical analysis are given.

PATENTS

BALKE, C. W. (TO FANSTEEL PRODUCTS CO. (INC.)). Removal of carbon impurities from tantalum. U. S. Patent 1,754,453, Apr. 15, 1930. Chem. and Ind., vol. 49, Oct. 3, 1930, p. 915.

Powdered tantalum containing small amounts of graphite is purified by heating it, in vacuo, with magnesia at a temperature at which the carbon will be oxidized and the resulting magnesium volatilized.

CANADIAN WESTINGHOUSE CO., LTD. Production of tantalum by electrolysis of fused compounds. Canadian Patent 300,953, June 10, 1930.

The electrolytic bath is made up of a mixture of fluorides, including an alkali fluoride and a double fluoride of an alkali metal and a refractory rare metal.

FANSTEEL PRODUCTS CO. (INC.) Method of removing carbon impurities from tantalum. Canadian Patent 299,739, Aug. 19, 1927.

———. Process for eliminating carbon from difficultly fusible rare metals, particularly tantalum. French Patent 693,417, Apr. 5, 1930.

RAMAGE, J. H. (TO WESTINGHOUSE LAMP CO.). Tungsten-tantalum alloy. U. S. Patent 1,741,953, Dec. 31, 1929.

TITANIUM

GENERAL CONDITIONS

Countercurrent to the general business depression that engulfed other industries the titanium industry made marked progress in 1930. Not until 1920 were titanium dioxide pigments marketed on a commercial scale; by 1929 the domestic consumption was in the neighborhood of 6,000,000 pounds. In 1930, despite a substantial reduction in the aggregate consumption of other pigment materials, the use of titanium pigments seems to have been well maintained. Only one price reduction was made during 1930 as compared with two reductions in 1929. The change was made in December and amounted to three-fourths cent a pound for barium and calcium base titanium pigments. These progressive reductions are interpreted as a reflection of continued economies in manufacture that have resulted from the rapidly increasing scale of production, rather than as an indication of an urgent necessity to work off stocks. It is, furthermore, significant that the announcement of this reduction was promptly followed by a 15 per cent reduction in the price of lithopone.

Among many diversified applications probably the chief factor in the growing popularity of titanium pigments is their employment in brush and spray lacquers; in bakelite and similar synthetic phenol and cresol condensation products; and in celluloid or pyroxylin plastics. Titanium dioxide is whiter than most of the other pigments and has a remarkably high covering power. Being virtually inert it does not react with the solvents ordinarily used. New colored pigments have been developed to accompany titanium pigments for certain purposes, and practically all lithopone makers in America[13] now offer special mixtures of lithopone and titanium dioxide. Titanium pigments also find growing use in the manufacture of linoleum, coated textiles, rubber, wall papers, printing inks, glass, and enamel ware.

The use of titanium in pigments is by far the leading tonnage outlet, but there is also a substantial demand for titanium alloys. Early in 1930 it was found that the addition of titanium in chrome-nickel combinations may permit the production of a steel that is safe from intergranular corrosion even when high-carbon stock must be used. An alloy with 0.15 per cent carbon and 0.75 titanium (5 or 6 times the carbon content) showed the same resistance to intergranular corrosion as a material of 0.09 to 0.06 per cent carbon. Experiments with titanium in glass formulas progressed during the year, and there is a small use of the bichloride and sulphate in the dye industry; the tetrachloride may also be employed for smoke screens in Army and Navy air corps maneuvers and possibly for "sky writing." Metallic titanium is so difficult to produce that little progress has been made in introducing commercial uses for the metal, but investigations have been in progress in the National Physical Laboratory in England to determine the effects of titanium, added as titanium tetrachloride, on various metals. This volatile compound is easily prepared, and if it should impart valuable qualities to any of the commercial metals, its use in industry could be established without apparent difficulty.[14]

A new domestic source of titanium was being developed during the year. At Piney River, the dividing line between Nelson and Amherst Counties in Virginia, the Southern Mineral Products Corporation, a wholly owned subsidiary of the Vanadium Corporation of America, constructed a group of chemical and mechanical concentrating plant buildings for the production of titanium and phosphate products. The company owns mineral rights underlying some 3,500 acres in the nelsonite belt. This belt which, according to Watson[15] is 12 miles long and 2½ miles wide, includes the property of the American Rutile Co., at Roseland, Va. The mine product is separated with the aid of magnetic machines yielding as principal materials ilmenite concentrates and apatite concentrates. The former of these materials is treated further to recover titanium dioxide, and the apatite is converted into phosphoric acid and phosphates. Operations at this plant, said to have cost between $1,250,000 and $1,500,000, are thus described in the Manufacturers Record: [16]

> * * * To the right of the mill building are steel silos on reinforced concrete foundations, with a capacity of 600 tons of ilmenite. From the storage silos, ilmenite is conveyed by a pneumatic handling system to the ilmenite chemical plant, and from an interior mill storage, apatite is transported by an independent pneumatic system to the phosphate plant.
>
> The ilmenite and apatite concentrates are chemically treated in these separate units for the production of titanium dioxide and phosphoric acid, and these two primary and technically pure products are either sold as such or converted in secondary plant units into titanium salts and phosphates.

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[13] Baldwin, Robert T., Use of Lacquers Has Given a Rebirth to Lithopone and Titanium Dioxide: Chem. and Ind. (London), vol. 49, No. 6, Feb. 7, 1930, p. 81T.

[14] Canadian Mining Journal, A Titanium Research: Vol. 51, No. 35, Aug. 29, 1930, p. 834.

[15] Watson, T. L., Geology of the Titanium and Apatite Deposits in Virginia: Virginia Geol. Survey Bull. III-A, 1913, pp. 100-155.

[16] Manufacturers Record, New Chemical Industry for the South: Apr. 9, 1931, pp. 38-40.

The principal reagent used for both primary processes is sulphuric acid, and because of the large quantities required, the plant units at Piney River include a contact sulphuric acid plant of the latest type, using a vanadium mass as the catalyst. The sole raw material for this process of sulphuric acid manufacture is sulphur, brought from Texas to Norfolk or Newport News by steamer and thence by a comparatively short rail haul to Piney River.

A considerable amount of the sulphuric acid used in the manufacture of titanium dioxide by the Southern Mineral Products Corporation process reappears at the end of the operation as an impure dilute acid. A recovery system has been devised and a recovery unit installed so that impurities are removed, the dilute acid is concentrated, and a strong acid, entirely suitable for re-use is recovered. The other reagents used in the processes are employed in small quantities; so, essentially, ilmenite, apatite, and sulphur are the basic raw materials, with the two most important—ilmenite and apatite—produced by a mine and mill adjacent to the chemical plants.

The chemical processes at Piney River demand large quantities of water, as most of the reactions are carried out in solution stage, and several of the process steps demand thorough washings of precipitates so that traces of foreign materials can be removed. The Piney River, which flows through the center of the property, provides an ample water supply. Even in the drought period of 1930 the river had a minimum flow several times that required by the plant. Test wells have also proven the existence of an underground water strata.

Steam required for the various process units is developed in a compact, coal-fired boiler plant designed by the Stone and Webster Engineering Corporation, and electric power is obtained over a special transmission line from the Appalachian Electric Power Company. In addition to the mill and process units, the plant group includes two warehouse buildings, mechanical, electrical, and carpenter shops, and a series of strategically located fire hose houses, which with an independent high pressure stand pipe system, provide adequate fire protection.

Rutile has been mined in the United States principally at Roseland, Va., although minor quantities of rutile as well as ilmenite were formerly produced in Florida from the treatment of beach sands. Rutile has been identified at a few other localities in the South Atlantic States, but the deposits as a rule have not proved extensive. A possible new commercial source of rutile was reported to the authors by E. L. Dinning of the Harford Talc Co. The deposit, which is about 1½ miles west of Pylesville Post Office, Harford County, Md., has been exposed across a large open pit, and a drill hole shows a continuation of the rutile-bearing formation to a depth of at least 80 feet. Laboratory tests indicate that a recovery of about 6 per cent of the gross weight of the material may be made in the form of clean concentrates by means of table concentration followed by magnetic separation. The final concentrates should contain 93 to 96 per cent TiO_2. Magnetite and amphibole are present in the table concentrates, which therefore contain only about 21 per cent of titanium oxide. The crude rock assayed about 8.6 per cent TiO_2.

Both in the United States and Canada the search continues for means of utilizing titaniferous magnetites and low-grade ilmenite. What may prove another large body of such ores is reported in a letter addressed to the Bureau of Mines by L. W. Fargo, secretary of the Vermillion Range Land Co., Chicago, Ill. The deposit, which is south of Gunflint Lake in Cook County, Minn., is said to yield ore containing 1⅞ per cent vanadium as well as 12 per cent titanium. A year or two ago a metallization process was worked out in the laboratories of the Canada Department of Mines for low-grade ilmenite containing 31.75 per cent TiO_2, 39 per cent iron, 7.7 per cent alumina, 7 per cent silica, and 2.6 per cent magnesia. At 990 to 1050° C. 94 per cent of the iron could be reduced to metal in a rotary furnace by means of coal. Leaching the product with

10 per cent sulphuric acid yielded a residue containing 75.8 per cent TiO_2, 6.27 per cent iron, and 0.8 per cent carbon. In common with sundry other processes for separating iron from titanium in ores the problem concerns disposal of the iron sulphate. Large quantities of copperas or ferrous sulphate are sold annually, but the demand is well supplied by existing sources, notably the pickling operations at steel works. New outlets for this by-product are envisaged by some chemists as a result of research into the more extensive use of iron salts in water purification and sewage disposal.

DOMESTIC PRODUCTION

During 1930 the American Rutile Co. (a subsidiary of the Metal & Thermit Corporation) shipped ilmenite and rutile from its properties at Roseland, Va. This plant formerly operated only every other year, but recently the demand has increased so that it has been more fully occupied. The output of titanium minerals during the past 10 years, so far as data are available to the Bureau of Mines for publication, is shown in the following table, which, however, shows shipments rather than production:

Titanium minerals produced in the United States, 1921–1930[1]

Year	Rutile concentrates			Ilmenite concentrates		
	Short tons	Percentage of TiO_2	Value	Short tons	Percentage of TiO_2	Value
1922	310	95	(2)	5,181	52–54	(2)
1923	270	95	(2)	6,270	52	(2)
1924	----------	----------	----------	4,769	52	[3] $76,300
1925	46	95	[3] $11,000	5,566	52	[3] 89,000
1926 [4]	30	95	[3] 7,500	4,813	52	[3] 77,000
1927	524	95	129,861	3,500	50	44,000
1928	176	93–96	[3] 37,700	918	50	[3] 21,000
1929	(2)	(2)	(2)	(2)	(2)	(2)
1930	(2)	(2)	(2)	(2)	(2)	(2)

[1] No production reported for 1921.
[2] Bureau of Mines not at liberty to publish figures.
[3] Arbitrary value.
[4] Figures for Florida only. Bureau of Mines not at liberty to publish figures for Virginia.

The new plant of the Southern Mineral Products Corporation did not come into production until early in 1931. Some further work was done on the beach deposits in California, but the Bureau of Mines has no record of shipments being made. Trumble Metals (Inc.) (W. T. Eckhoff, secretary), of San Francisco, reports that by water concentration its black sands along Monterey Bay yield a product containing 8.70 per cent TiO_2, 4.65 per cent ZrO_2, and about 53 per cent iron. The Aluminum Co. of America obtains titanium by-products in the purification of bauxite for aluminum manufacture.

Titanium pigments were manufactured in the United States from ilmenite by the Titanium Pigment Co., a subsidiary of the National Lead Co., with plants at St. Louis and Niagara Falls, and by the Commercial Pigments Co., a subsidiary of the Commercial Solvents Corporation, with a plant at Baltimore. Early in 1931 the Titanium Pigment Co. announced its intention to transfer all its pigment business to St. Louis. Fifty-five men were reported to be affected by the change. The manufacture of ferrocarbontitanium by the Titanium Alloy Manufacturing Co. (an affiliated concern) will be continued at Niagara Falls. Carbide-free ferrotitanium is produced by the Metal & Thermit Corporation. Ilmenite is the chief raw material for these alloys, as well as for the pigments. Rutile is used chiefly in the ceramic industry, especially in tile and in dinner ware, to add color and strength.

IMPORTS

Ilmenite sand is imported extensively from Travancore, India, and from Senegal. From time to time shipments have also been made from Brazil. The imports of ilmenite, as recorded by the Bureau of Foreign and Domestic Commerce, amounted to 24,973 short tons, valued at $150,466, in 1930. This quantity is a trifle less but the value 43 per cent more than the imports of 25,072 tons, valued at $104,887, in 1929. Much of the ilmenite imported is from beach deposits, in which it occurs associated with monazite and zircon. In former years undoubtedly much ilmenite was included in the statistics for sand and other items, which, like ilmenite, are exempt from duty. A study of the records for 1929, however, indicated that this situation was much improved, although even now some of the ilmenite imported probably escapes being recorded under its special category. In Quebec, for example, deposits of massive ilmenite are worked at Ivry and at Baie St. Paul; the ore, which contains up to 38 per cent of TiO_2, is shipped to the United States, but this movement does not appear in the import statistics.

Rutile is imported from Norway, but only in small amounts. This mineral is also associated with the ilmenite produced at St. Urbain, near Baie St. Paul, in Quebec, and shipped to the General Electric Co. works at West Lynn, Mass. In 1930 the total imports of rutile were 3 short tons, valued at $974.

WORLD PRODUCTION

The world production of titanium minerals in 1929 and 1930, as gathered from Government reports and other available sources, is shown in the following table:

World production of titanium minerals, 1929 and 1930

Mineral and country	1929			1930		
	Ore produced	Content of TiO_2	Value[1]	Ore produced	Content of TiO_2	Value[1]
Ilmenite	*Metric tons*	*Per cent*		*Metric tons*	*Per cent*	
Brazil[2]	6,361	(3)	$75,109	80	(3)	$1,370
Canada (Quebec)	2,493	(3)	7,304	374	(3)	1,237
India (Travancore)	24,050	(3)	139,067	(3)	(3)	(3)
Norway	7,923	43	63,500	7,630	43	63,400
Portugal	56	50	250	(3)	(3)	(3)
Senegal	[2] 7,240	(3)	24,280	[2] 5,322	(3)	7,377
United States	(4)	(4)	(4)	(4)	(4)	(4)
Rutile						
Norway[5]	43	90-93	13,600	46	90-93	13,400
United States	(4)	(4)	(4)	(4)	(4)	(4)

[1] Values as officially reported, converted to United States currency at the annual average rate of exchange as published by the Federal Reserve Board.

[2] Exports.

[3] Data not available.

[4] Bureau of Mines not at liberty to publish figures.

[5] Concentrates.

THE INDUSTRY IN FOREIGN COUNTRIES

Exports from Brazil, which increased to 6,361 metric tons in 1929, dropped to small proportions in 1930. The deposits are beach sands on the coast of the States of Rio de Janeiro, Espirito Santo, and Bahia. Three firms were recently reported to be working the Brazilian deposits. In Ceylon several large deposits of concentrated black sand have been discovered; the largest of these, at Pulmoddaii, is estimated to contain at least 2,000,000 tons of ilmenite.[17] Licenses for the exploitation of such beach deposits may be granted under a Government decree passed in 1926, but none have been worked commercially as yet. A Ceylonese firm, however, is reported to have obtained a concession from the Indian Government for operating deposits in the southern Travancore area that will produce ilmenite, monazite, and zircon. The Radium & Rare Earths Treatment Co., owning property at Olary, South Australia, engaged a German chemist to develop a process for making pigment from its ilmenite ores.

The Fabriques de Produits Chimiques of Thann and Mülhouse started the manufacture of titanium white in France in 1923, using the processes of the Société Française de Produits Chimiques des Terres Rares.[18] This is the same process employed in the United States by the Commercial Pigments Corporation at Baltimore and also by the Italian company, the Società Anonima Titanium, at Bovisa-Milano and by The United Manufacturers of Chemical & Metallurgical Products at Aussig in Czechoslovakia. The French product is sold under the name of "Thann" white, and the output is around 600 tons annually. The Compagnie Générale de Produits Chimiques de Louvres is planning to operate a plant using a different process. In Germany the Titanium Pigment Co. has licensed its process to the Titan G. m. b. H., a subsidiary of the German Dye Trust, with a titanium pigment plant at Leverkusen where the I. G. Farbenindustrie's lithopone interests are also centered.

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The following articles on titanium, to which is appended a list of patents, are among those that appeared or became available in 1930:

AGAMENNONE, G. Determination of titania in titanium white. Giorn. Chim. Ind. Appl., vol. 12, 1930, pp. 123–124. Brit. Chem. Abs., vol. 49, No. 28, July 11, 1930, pp. 622–623.

AMERICAN METAL MARKET. Hiduminium—a new alloy development. Vol. 37, June 26, 1930, pp. 3–4. Metallurgia, vol. 2, June, 1930, pp. 52–53. Metals and Alloys, vol. 1, No. 18, December, 1930, p. 898.

ANDREWS, A. I. Titanium, zirconium and antimony in enamels. Ceram. Ind., vol. 14, p. 295. Foote-Prints, vol. 3, No. 1, 1930, p. 52.

Titanium oxide improves the acid resistance and does not increase the refractoriness as much as silica. Zirconium oxide is satisfactory as a mill addition. Antimony oxide, substituted for silica, improves the opacity, etc.

ASKEW, H. O. Titanium in New Zealand soils. New Zealand Jour. Sci. Tech., vol. 12, 1930, pp. 173–179.

Titanium in New Zealand soils ranges from 0.25 to 1.50 per cent. There appears to be correlation between titanium and iron content, both elements increasing together, but none between titanium and manganese.

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[17] U. S. Bureau of Foreign and Domestic Commerce, World Trade Notes on Chemicals and Allied Products: Vol. 5, No. 9, Mar. 2, 1931, p. 4.

[18] Debuigne, Jean, France Satisfactorily Balances Chemical Production and Consumption: Chem. Markets, vol. 28, February, 1931, p. 145.

Baldwin, Robert T. Use of lacquers has given a rebirth to lithopone and titanium dioxide. Chem. and Ind. (London), vol. 49, No. 6, Feb. 7, 1930, p. 81T.

The spreading use of lacquers has given a rebirth to titanium dioxide. This valuable filler and pigment has a superior covering power, a permanent whiteness, and a compatibility with some solvents that assures it a place in the lacquer run. Practically all lithopone makers in America now offer special mixtures of lithopone and titanium dioxide. At least one process of manufacture of titanium dioxide yields ferrous sulphate as a by-product, and ingenious uses for it have been recently put into operation in water purification and sewage disposal.

Chemistry and Industry (London). The chemistry and geochemistry of the titanium group. Hugo Muller lecture. Chem. Soc., Annual General Meeting. Vol. 49, No. 14, Apr. 4, 1930, p. 278.

The percentages of the various elements in igneous rocks were given as follows: Ti 0.5, Zr 0.02, Hf 4×10^{-4}, Th 1×10^{-4}, V 0.02, Nb 1×10^{-5}, Ta 6×10^{-6}, Pa 4×10^{-10}.

de Lapparent, Jacques. Titanium content of bauxites. Compt. Rend., vol. 190, 1930, pp. 1312-1314. Chem. Abs., vol. 24, No. 16, Aug. 20, 1930, p. 3969.

A discussion of the origin of titanium in bauxite.

Ditler, Emil. Degree of oxidation of titanium in silicates. 42 pp. Reviewed in Tonind.-Ztg., vol. 54, 1930, p. 268. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 6, June, 1930, pp. 474–475.

Fioletov, A. Occurrence of rare elements in clays. Keram. Rundsch., 1927, vol. 35, pp. 270–272; Chem. Zentralb., 1929, ii, p. 2489. Chem. and Ind., vol. 49, No. 23, June 6, 1930, p. 509.

Primary Russian clays contain 0.22–1.35% TiO_2, and secondary clays 0.94–2.72%. The clays and kaolins examined contained 0.004–0.075% V_2O_5. A method for the determination of vanadium in clays is described.

Guimaraes, N. D. Separation of uranium, zirconium, tantalum, niobium, titanium, iron, manganese, lead, tin, copper, nickel, and chrome. Ann. Acad. Brasil. Sc., vol. 1, December, 1929, pp. 198–200. Chim. et Ind., vol. 24, No. 1, July, 1930, p. 41.

Heaton, Noel. Titanium oxide pigments. Chem. and Ind., vol. 48, 1929, pp. 1090–1091. Jour. Am. Ceram. Soc., vol. 13, No. 2, February, 1930, p. 87.

The industrial development of titanium compounds since the formation of the first company in Norway in 1860 is described.

Hirsch, Hans. Action of titanic acid on refractory materials. Tonind.-Ztg., vol. 54 (47), 1930, pp. 773–776. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 10, October, 1930, p. 851.

The best-known titanium minerals are titanium dioxide, appearing as rutile, anatase, and brookite, titanium iron ores and ilmenite, perosskite, and titanite. Titanium dioxide is a refractory material. Investigations showed that objects with 99% of titanium dioxide and only traces of iron could be fused at Seger cone 35. Its behavior at fusion resembles that of quartz and shows a similar viscosity. Rutile in consequence of its iron-oxide content has a lower fusing temperature. Additions of TiO_2 to raw materials used in the refractory industry have apparently no influence on their fusion. Investigations were carried on to find the proportion of TiO_2 in different clays and grogs, and showed an average content of 1 to 1.5% TiO_2. The results of further experiments are as follows: (1) A 2% addition of TiO_2 only slightly impairs refractoriness and softening under pressure. (2) A 10% addition lowers refractoriness about 3 Seger cones. In binding and sagger clays the action of TiO_2 is greater. The process of shrinkage is not much influenced in sagger and binding clays. (3) A 2% addition of TiO_2 does not influence shrinkage of kaolin, but a 10% addition greatly increases it. A change of color to ivory and yellow also takes place. (4) The influence of 1% titanium dioxide in combination with other fluxes, 2% iron oxide, 0.5% magnesium oxide, and 0.7% calcium oxide, was tested. The two latter together with titanium dioxide do not influence in general the softening under pressure and refractoriness. These tests showed that titanic acid in small quantities does not change materially the properties of refractory clays.

Hueber, H. Determination of titanium and iron in rocks. Tschermak's mineral. petrogr. Mitt., vol. 40, 1929, pp. 192–195. Chem. Abs., vol. 24, No. 18, Sept. 20, 1930, p. 4479.

TiO_2 is determined colorimetrically with H_2O_2 in the H_2SO_4 solution of sesquioxides and Fe_2O_3 is determined by precipitation with NH_3.

Mathesius, H. Determination of small amounts of titanium in alloy steels. Chem. Ztg., 1930, vol. 54, pp. 134–135. Chem. and Ind. (London), vol. 49, No. 16, Apr. 18, 1930, p. 330.

Michel, Andre, and Benezat, Pierre. The influence of titanium on transformation points of steel. Rev. Metal., vol. 27, June, 1930, pp. 326–333. Chim. et Ind., vol. 23, 1930, pp. 237–242. Metals and Alloys, vol. 1, No. 17, November, 1930, p. 856.

A study made with Chevenard dilatometer and Saladin-Le Chatelier recalescence point apparatus showed that for 0.10–0.17% C steels, 0.5 and 0.8% Ti raise Ac_2 to 780° and bring Ac_3, respectively, to 980 and 1080°. Added to 13% Cr low carbon steel it acts more pronouncedly raising the transformation point to 890° with 0.11% Ti, to 900° with 0.14% Ti and pushing it beyond 1140° by 0.60% Ti. Quenching from under 1300° develops in Cr steels only martensite, above it delta phase appears and the amount of it increases with the rise of temperature. Microscopical evidence is clear in case of 13% Cr, 0.84% Al steels but does not show anything definite in Cr-Ti steels. 17 curves and 5 microphotographs are given.

Pfanhauser, J., and Tomaszewski, S. Analysis of titanium white. Przemysl Chem., 1930, vol. 14, pp. 353–355. Chem. and Ind. (London), vol. 49, No. 44, Oct. 31, 1930, p. 997.

Powell, A. R., and Schoeller, W. R. Investigations into the analytical chemistry of tantalum, niobium, and their mineral associates. XVIII. A new method for the separation of titanium from zirconium and hafnium. Analyst, vol. 55, No. 655, October, 1930, pp. 605–612.

Thornton, W. M., and Roseman, R. Use of potassium titanium oxalate for preparation of a standard titanium solution in colorimetry. Chem. News, vol. 141 (3671), 1930, pp. 119–120. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 12, December, 1930, pp. 1103–1104.

Young, Ralph C., and Schumb, Walter C. The anhydrous lower bromides of titanium. Jour. Am. Chem. Soc., vol. 52, No. 11, November, 1930, pp. 4233–4239.

Zachariasen, W. H. Crystal structure of titanite. Ztschr. Kristal., vol. 73 (1), 1930, pp. 7–16. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 10, October, 1930, p. 881.

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Bancroft, G. J. Treatment of ferrotitanium (ilmenite) ores. U. S. Patent 1,745,732, Feb. 4, 1930. British Chem. Abs., vol. 49, No. 30, July 25, 1930, p. 669.

Titaniferous iron ores are ground with fluorspar and carbonaceous material and the mixture is heated in a reducing atmosphere to produce iron sponge and calcium fluotitanate. The reduced mass is discharged through steam into water containing a small proportion of sodium hydroxide, and the granular product is ground wet, screened to remove coarse iron, and concentrated on Wilfley tables or by means of a magnetic separator.

Blumenfeld, J. Production of oxides of titanium. British Patent 307,881, Mar. 11, 1929. Chem. and Ind. (London), vol. 49, No. 33, Aug. 15, 1930, p. 765.

A titanium halide (e. g., tetrachloride) distributed upon a soluble salt, e. g., an alkali chloride or sulphate, is treated with steam and the mass is calcined, cooled, and extracted with water to remove the salt; the product is obtained in a finely divided form suitable for use as a pigment.

Brockbank, C. J. Refractory crucibles. British Patent 322,476, Sept. 3, 1928. Chem. and Ind. (London), vol. 49, No. 8, Feb. 21, 1930, p. 145. Brit. Chem. Abs.

Titanium dioxide, silicate, or aluminate is added to the clay bond used in the manufacture of graphite and carborundum crucibles. When fired at cone 5–10 a very strong mass is produced having a glazed surface which prevents the oxidation of the graphite, etc.

Chihoutzky, G. S. (U. S. S. R.) Obtaining concentrated titanium dioxide. British Patent 34,016, Oct. 12, 1928. Chim. et Ind., vol. 24, No. 5, November, 1930, p. 1140.

Ilmenite is heated with barium sulphate, calcium chloride, and carbon in a current of nitrogen. The product is extracted with boiling water and then with weak acid.

Deutsche Gasgluhlicht-Auer-Ges. m. b. H. Purification of impure titanium dioxide. British Patent 309,598, Apr. 10, 1929. Chem. and Ind. (London), vol. 49, No. 20, May 16, 1930, p. 419. British Chem. Abs.

The dioxide is freed from contaminating chromium oxide by mixing with a small excess of alkali or alkaline earth (magnesia, alkali, carbonate, etc.), drying, roasting at incandescent heat, and lixiviating out the soluble chromate with water or dilute acid. Oxidizing agents may be added to accelerate the formation of chromate.

Deutsche Gold und Silber-Scheideanstalt vorm. Roessler und Weiss, L. Tin, titanium and zirconium oxides. British Patent 327,142, May 21, 1930. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, August, 1930, pp. 622–623.

To obtain highly dispersive oxides of tin, titanium, or zirconium, suitable for use as pigments, turbidity agents for vitreous enamels, etc., soluble compounds of these metals are allowed to react in their normal conditions or in the presence of limited quantities of solvents with substances capable of converting them into oxides, e. g., alkaline lyes, steam, ammonia, etc., and the oxides or hydroxides produced are heated in the case of pigments from 500 to 800° C. and turbidity agents from 900 to 1500° C. to convert them into a voluminous form. The initial reaction can take place either in the liquid phase or between the vapors of the reactants. If the reaction in the vapor phase takes place above 600° C., the subsequent heating may be omitted. In examples, (1) titanium tetrachloride in the form of vapor is allowed to react with superheated steam at 500° C. and the oxide formed is washed, dried, and heated from 600 to 800° C. to produce a pigment; (2) zirconium oxychloride or a concentrated solution thereof is stirred with concentrated ammonia solution, the pasty mass diluted with water, and the precipitate washed, dried, and heated from 1200 to 1400° C. and a turbidity agent obtained; (3) the vapor of stannic chloride is treated with superheated steam at 300° C., and the oxide product is washed, dried, and heated to a little above 900° C. to produce a turbidity agent. See also Brit. 296,730, Ceram. Abs., vol. 8 (2), p. 151 (1929); Brit. 203,352 and 206,284.

Farbenindustrie, I. G., A.-G. Titanium compounds. Canadian Patent 285,355, Dec. 4, 1928. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 8, August, 1930, p. 681.

Ti compounds are manufactured by working up ilmenite with strong or fuming H_2SO_4 acid, dissolving the strongly acid material in water with the addition of a suitable quantity of K_2SO_4, isolating the double sulphate thus obtainable, and hydrolyzing. E. g., 1000 parts of strongly acid material obtainable by working up ilmenite with H_2SO_4, which contains $Ti(SO_4)_2$ in a quantity equivalent to about 17% TiO_2, is quickly heated with 2500 parts of water and 400 parts of K_2SO_4 to 95°. The solution is filtered while hot. In the cold, i. e., at about 0 to 5°, the double sulphate separates in about 65 to 75% the quantity calculated on the dissolved Ti. The greatest part of the rest of the double salt may be isolated by evaporating.

——— Titanic acid. French Patent 35,377, May 25, 1928. Addition to 653,893. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 11, November, 1930, p. 990.

Easily soluble Ti compounds and very pure TiO_2 are prepared by rapidly heating with K_2SO_4 and water the product obtained by treatment of ilmenite with H_2SO_4, filtering this solution, and washing the residue with H_2SO_4.

——— Manufacture of concentrated titanyl and titanic sulphate solutions. British Patent 309,090, Apr. 4, 1929. Chem. and Ind. (London), vol. 49, No. 38, Sept. 19, 1930, p. 862.

A moderately hot solution (e. g., not exceeding 60°) of metatitanic acid in sulphuric acid is saturated with metatitanic acid, and then orthotitanic acid is added and the mixture concentrated in vacuo (e. g. at 70-90°). The titanic acids may be added in solid form or in aqueous solution. The solutions obtained are substantially free from iron and are adapted for use as tanning agents and mordants.

——— Titanium compounds from ores. German Patent 490,600, Mar. 12, 1926. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 8, August, 1930, p. 681.

Ti ores are treated at high temperature with dilute H_2SO_4 in the presence of reducing agents, preferably compounds of tervalent Ti compounds. Thus, ilmenite, containing approximately 55% TiO_2 and 33% Fe, is heated with 40% H_2SO_4 and Cu to 180° for 6 hrs. On lixiviating the matrix, H_2TiO_3 with about a 0.5% Fe content is obtained. Without the reducing agent, the Fe content is about 20%. Other examples are given.

——— Process for extracting titanium ore. German Patent 497,931, Dec. 18, 1926. Metals and Alloys, vol. 1, No. 13, July, 1930, p. 641.

——— Process for decomposing titaniferous ores. Italian Patent 265,939, Jan. 20, 1928. French Patent 630,630, Mar. 10, 1927. Metals and Alloys, vol. 1, No. 13, July, 1930, p. 642.

Farup, Peder. Precipitating titanium compounds. U. S. Patent 1,773,727, Aug. 26, 1930. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 11, November, 1930, p. 989.

The process of precipitating titanium compounds by hydrolysis which comprises heating a titanium solution to cause precipitation of titanium compounds therein, and adding during the precipitation another titanium solution in amount sufficient to maintain a substantially constant composition and to make up for the titanium compounds so precipitated.

Gregory, Arnold William. Treatment of ores for the recovery of titanium. U. S. Patent 1,734,034, Nov. 5, 1929. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 1, January, 1930, p. 69.

Process of removing the iron from titanic iron ores which consists in pulverizing the ore, mixing the pulverized ore with sufficient free carbon to combine with substantially all of the oxygen in the iron oxide of the ore and with a fusible alkaline salt, heating the mixture in the absence of free oxygen to a bright red heat to cause combination of the carbon with substantially all of the oxygen of the iron oxide content and production of free iron in a dispersed state, and immediately treating the whole mass with dilute acid capable of combining with the free iron in quantity at least sufficient to combine with all the free iron, and to neutralize the alkaline salt whereby to resolve all the iron content of the ore to an iron salt in solution.

Kendall, Sydney W. Proofing textile materials against insects, etc. U. S. Patent 1,739,840, Dec. 17, 1929. Chem. Abs., vol. 24, 1930, p. 977.

Fatty acid salts of yttrium, thallium, or titanium are used as impregnating agents.

Laporte, B., Weber, I. E., and Bennett, A. N. C. Pigment from titanium oxide and barium sulphate. British Patent 315,904, Apr. 17, 1928. Chem. Abs., vol. 24, 1930, p. 1753.

A mixture for calcination is prepared by adding $BaSO_4$ to, or forming it in, a fine dispersion of titanium oxide and coagulating the dispersed oxide. Various details of procedure are described.

Mathesius, W., and Mathesius, H. Production of titanium steel. British Patent 329,705, Feb. 25, 1929. Chem. and Ind. (London), vol. 49, No. 32, Aug. 8, 1930, p. 720.

Steels containing not more than 1 % C and 0.8 % Ti with small additions of silicon, manganese, chromium, and other metals which improve the properties are claimed, a preferred composition being 0.1 % C, 0.2 % Ti, 0.5 % Si, 0.5 % Mn, and 0.5 % Cr. The steel is produced by deoxidizing a bath containing less than 0.1 % C by the addition of carbon-free silicides of ferromanganese, ferrochromium, or ferromanganese-chromium having such a carbon content that 0.1 % C remains in the bath, the requisite titanium is then added as carbon-free ferrotitanium.

Mathesius, W., and Mathesius, H. Production of titanium steel. British Patent 337,715, Mar. 16,1929. Chem. Age, vol. 23, No. 595, Nov. 22, 1930, p. 485.

——— Titanium. British Patent 333,816, Oct. 8, 1930. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 12, December, 1930, p. 1105.

In a process for producing homogeneous titanium or ferrotitanium melts by alumino-thermic reaction, salts of the acids derived from the oxides of the heavy metals are added to the mixture in order to effect a regular decomposition of the regulus. Chromates, tungstates, manganates, permanganates, and uranates are specified, either as salts of iron, nickel, cobalt, manganese, uranium, tungsten, molybdenum, vanadium; in the latter case, the metallic radical passes together with the metal of the acid radical into the titanium or ferrotitanium regulus.

——— Titanium steel. Australian Patent 25,628. Ind. Australian and Min. Stand., vol. 84, No. 2169, Nov. 20, 1930, p. 378.

To produce homogeneous titanium steel, briquetted or pulverized titanium thermic mixture is placed in a ladle, and upon this mixture molten deoxidized decarbonized steel is discharged from the bottom of a second ladle. The steel to be alloyed with titanium is first deoxidized and decarbonized in a ladle, which has a relatively large discharge opening, through which this prepared steel is discharged in a strong jet into a second ladle, containing the pulverized or briquetted thermic mixture, which is immediately ignited, setting up violent movement, which causes the titanium separated out in the reaction to be readily taken up by the molten steel to form a perfectly homogeneous alloy.

——— Process for obtaining iron-titanium alloys containing a high percentage of titanium. French Patent 684,474, Nov. 6, 1929. Metals and Alloys, vol. 1, No. 12, June, 1930, p. 584.

——— Process for producing homogeneous or ferrotitanium melts capable of being poured. French Patent 684,210, Oct. 30, 1929. Metals and Alloys, vol. 1, No. 12, June, 1930, p. 584.

Mecklenburg, Werner. Production of titanium dioxide. U. S. Patent 1,758,528, May 13, 1930. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 7, July, 1930, p. 586.

(1) A process for preparing a seed suspension which comprises reducing the acidity of titanium sulphate solution to a hydrogen-ion concentration of about 2.5 to 6.0, heating the mixture to about 80° C for 15 to 30 minutes, and cooling the mixture. (2) A process for the production of titanium dioxide which comprises adding a mixture containing titanium hydroxide in aqueous suspension containing sodium sulphate to a solution of titanium sulphate, and maintaining the mixture at a temperature near the boiling point. (3) A process for the hydroylsis of titanium sulphate solution which comprises adding sufficient alkali to a small portion of the solution to reduce the acidity of 2.5 to 6.0 and to precipitate titanium hydroxide therein, heating the mixture to about 80° C for 15 to 30 minutes, adding the mixture to the rest of the titanium sulphate solution, and maintaining the mixture at a temperature near the boiling point.

Monk, R. H. Production of titanates of alkaline earths. British Patent 655,399, Dec. 17, 1928.

Monk, R. H., and Firing, L. (The latter assr. to J. Irwin.) Production of alkaline-earth titanates. U. S. Patent 1,760,513, May 27, 1930. Chem. and Ind., vol. 49, No. 52, Dec. 26, 1930, p. 1151.

An aqueous paste of freshly-precipitated titanium hydroxide is treated with an acetate of an alkali metal or ammonium to react with any sulphate ions, which are detrimental to the formation of titanates. After washing with water to remove the sulphate, an alkaline-earth carbonate, e. g., barium carbonate, is added in the form of paste to produce a compound such as $BaTiO_3$. Hydrochloric acid or barium chloride is added to accelerate the reaction and give the product a pure, white color, and the mixture is finally heated to 750–880°.

Palmer, Ralph M. Titanium oxide. U. S. Patent 1,760,992, June 3, 1930. Chem. Abs., vol. 24, 1930, p. 3614.

The residue from a digestion process for recovering the aluminum content of bauxite is subjected to wet concentration to separate iron oxide; TiO_2 is magnetically separated from the ferrotitanium oxide and iron oxide, and the ferrotitanium oxide and iron oxide are magnetically separated from each other.

Rich, Malcolm N. (to Canadian Westinghouse Co., Ltd.) Separation of zirconium, titanium, and hafnium. Canadian Patent 301,654, July 1, 1930. Chem. Abs., vol. 24, Aug. 20, 1930, p. 4126.

Titanium, zirconium, and hafnium are extracted from their ores and precipitated as hydrated oxides. The metals are then separated according to the solubility of the oxides in acid alkali sulphates.

Ryan, L. W. (to Titanium Pigment Co.) Titanium compounds. British Patent 308,725, Mar. 27, 1928. Chem. Abs., vol. 24, 1930, p. 473.

Hydrolytic precipitation of titanium compounds from aqueous solutions containing inorganic acid is effected in the presence of organic acids such as tannic, citric, oxalic, or gallic acids or of H_3PO_4 or of salts of these or similar acids. The hydrolysis product may be calcined at 700–1000° to obtain a white pigment of TiO_2, which may contain, e. g., 0.6–1.3 per cent P_2O_5. Various details of procedure are given.

Schnetka, Moritz. Production of titanic oxide. U. S. Patent 1,758,472, May 13, 1930. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, July, 1930, p. 586.

(1) In the process for the hydrolytic precipitation of white titanic acid from sulphuric acid solutions containing titanium sulphate and iron sulphate, the step which comprises carrying out the precipitation in the presence of a compound of the group consisting of hydrofluoric acid and water-soluble fluorides. (2) Carrying out the precipitation in the presence of hydrofluoric acid.

TITANIUM PIGMENT CO. (INC.). Manufacture of titanium oxide. U. S. Patent 1,758,472, Sept. 6, 1927. Chim. et Ind. (France), vol. 24, No. 2, August, 1930, p. 397.

Titanium white is precipitated from solution of sulphates of titanium and iron in presence of hydrofluoric acid or with addition of soluble fluorides in solution.

——— Paints. British Patent 329,333, Nov. 12, 1928. Chem. Abs., vol. 24, No. 21, Nov. 10, 1930, p. 5516.

An oil paint is formed comprising a pigment of Ti compounds such as the oxide, a vehicle composed mainly of a drying oil such as linseed oil and a small proportion of cellulose nitrate which may be dissolved in BuOAc or like solvent. Usual driers and an extender base such as $BaSO_4$ may be added. Details of manufacture are given. Cf. C. A. 24, 1527.

——— Titanium compounds. French Patent 672,002, Mar. 25, 1929. Jour. Am. Ceram. Soc., Abs. Bull., vol. 9, No. 8, August, 1930, p. 681.

Ti compounds are precipitated in a very fine state by adding organic acids, e. g., oxalic acid, to a solution containing Ti and an inorganic acid, such as H_2SO_4, at a temperature of about 90°. French Pat. 672,003 describes a similar process in which a mixture of an organic acid and phosphoric acid or a compound thereof are added to the solution.

URBAIN, E. Process for the simultaneous preparation of calcium titanate and ferrophosphorus. French Patent 684,889, Feb. 13, 1929. Metals and Alloys, vol. 1, No. 13, July, 1930, p. 640.

VON BICHOWSKY, F. Production of titanium (di) oxide. U. S. Patent 1,742,674, Jan. 7, 1930. Chem. and Ind. (London), vol. 49, No. 19, May 9, 1930, p. 418.

Titanium nitride prepared as previously described (cf. U. S. Patent 1,408,661) is treated with dilute nitric acid: $5Ti_2N_2\text{-}8HNO_3\text{-}10TiO_2\text{-}4H_2O\text{-}9N_2$. Alternatively, the nitride may be heated with concentrated sulphuric acid containing a metal (sodium) nitrate or nitric acid; the cooled solution is then poured into cold water, when all the titanium enters solution as sulphate and is precipitated as pure oxide on boiling. Any iron present must be kept in solution by having hydrochloric acid, chlorine, or sulphuric acid present. The oxide obtained is finely divided and suitable for pigments. A method of directly obtaining a titania-barytes paint base is described.

WADE, H. (from Titanium Pigment Co. (Inc.)). Titanium paints. British Patent 329,333, Nov. 12, 1928. Chem. and Ind., vol. 49, Aug. 22, 1930, p. 779.

Paints comprising titanium pigments, a vehicle consisting principally of a drying oil, and a small proportion (e. g., 5 per cent of the weight of the paint) of cellulose nitrate as hardening agent are claimed.

WILLETTS, PAUL G. Refractory for molten glass. Canadian Patent 301,903, July 8, 1930. Chem. Abs., vol. 24, 1930, p. 4370.

A refractory for use in contact with molten glass. The composition is as follows, aluminum oxide 35.23 per cent, silica 62.54 per cent, titanium oxide 1.37 per cent, iron oxide, 0.78 per cent. lime 0.04 per cent, magnesia 0.16 per cent, and sodium oxide 0.45 per cent.

MANGANESE AND MANGANIFEROUS ORES[1]

By Robert H. Ridgway[2]

CONTENTS

	Page
Introduction	297
Summary for 1930	299
Domestic production	300
Classification of manganese-bearing ores	300
Metallurgical manganese ore	300
Ferruginous manganese ore	301
Manganiferous iron ore	302
Battery ore	302
Fluxing ore	303
Review by States	303
Alabama	304
Arizona	304
Arkansas	305
California	305
Colorado	305
Georgia	306
Idaho	306
Michigan	306
Minnesota	306
Montana	307
Nevada	308
New Mexico	308
North Carolina	309
South Dakota	309
Tennessee	309
Texas	309
Utah	309
Virginia	309
Washington	310
Porto Rico	310
Domestic production—Continued.	
Producers of domestic manganese ore	311
Price of manganese ore	311
Imports of manganese ore	312
Tariff	315
Consumption of manganiferous raw materials	315
Ferrous-metallurgical industry	317
Ferromanganese	319
Tariff on ferromanganese	321
Price of ferromanganese	321
Spiegeleisen	322
Manganiferous pig iron	323
Battery industry	323
Miscellaneous industries	323
World production	324
Russia	325
India	327
Gold Coast	327
Brazil	328
Union of South Africa	328
Egypt	329
Morocco	330
Cuba	330
Canada	330
Palestine	331
Manganese ore imported into main consuming nations	331

INTRODUCTION

Before the World War the domestic production of manganese ore was very small compared with the domestic consumption. The average annual output from 1900 to 1914, inclusive, was about 5,000 long tons; imports during the same period averaged about 223,000 long tons. At the time of the World War the requirement for manganese in the United States expanded, and some of the transport of imported ore was seriously menaced. Domestic production grew under the impetus of exceptionally high prices and urgent governmental requests for increased output. In 1918 it reached a peak of nearly 306,000 tons, which was about 38 per cent of the total manganese-ore requirements in the United States during that year. The average grade of domestic ore was not, however, as high as the grade of ore from foreign sources, but domestic ores were commonly mixed with higher-grade foreign ores. Pre-war requirements as to grade were also greatly modified, the manganese content of ferromanganese being reduced from 80 per cent to 60 and 70 per cent; some steel makers who formerly used ferromanganese substituted spiegeleisen, which could be made from the lower-grade domestic ores.

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[1] Work on manuscript completed July, 1931.

[2] Statistics on domestic output prepared by H. W. Davis and data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

This state of affairs terminated abruptly with the signing of the armistice. Prices declined immediately, and many war-time contracts were canceled; in consequence much domestic production became unprofitable, and a number of producers who had developed properties af a considerable cost, expecting the war to last much longer, faced heavy losses. Congress intervened, however, with appropriations to reimburse the producers for their war-time losses.

Under postwar conditions domestic production dwindled rapidly and by 1922 amounted to only 13,000 tons. Meanwhile, a demand for tariff protection had developed. Proponents of the tariff claimed that a domestic supply of such an important raw material as manganese ore was essential to the country in war and that the experience during the World War indicated that a substantial manganese-ore industry could be developed under proper tariff protection. Opponents of the tariff claimed that the war-time manganese-ore production was largely uneconomical and that the known manganese-ore reserves of the country did not justify the assumption that a substantial industry could be developed in competition with large high-grade foreign deposits, even under a protective tariff.

The tariff act of 1922, which became effective during the latter part of that year, established a duty of 1 cent per pound of contained manganese on imported ores containing in excess of 30 per cent of manganese. The effect of this act was immediately reflected in the domestic price of manganese ore. Domestic production of manganese ore rose to a postwar peak of 98,000 tons in 1925, which was equivalent to about 14 per cent of the domestic requirements in that year. Nearly half of the 1925 output was derived from the rhodochrosite ores of the Butte district, and about a fifth of the total represented the production of battery ores from the Philipsburg (Mont.) district. Imports increased from 425,000 tons in 1922 to 615,000 tons in 1925.

The increase in domestic production from 1922 to 1925 was accompanied by a steady increase in price, but by 1925 the production of foreign ores had increased to such an extent that there was severe competition for the world's markets and the price of manganese began a steady decline. At the same time changing design in radio receiving sets caused the demand for battery ore to drop steadily. These factors were reflected in the drop in domestic production to an average of about 46,000 tons in the period 1926 to 1928, due largely to curtailment in the Butte and Philipsburg districts.

Meanwhile, more and more attention was directed to the beneficiation of low-grade ore bodies. Many processes were developed to treat various types of low-grade ores. The outstanding of these was the sintering of rhodochrosite ores of the Butte district, which began in 1927. As a result of increased production in this district, the domestic production of high-grade manganese ore rose to more than 60,000 tons in 1929.

While the tariff was being considered in 1929, Congress was requested by the manganese-ore producers to increase the tariff on manganese ore and to extend the duty to ores containing less than 30 per cent of manganese. It was claimed that the domestic industry had progressed under the protection granted it in 1922 and that further protection was needed to put the processes being developed to treat low-grade ores on a commercial basis. Opponents of the tariff contended that the record of production under seven years of protection proved the contention made by them in 1922—that the known reserves were insufficient to provide an adequate supply of manganese, even with tariff protection. They also contended that the imposition of high duties to sustain production from low-grade ore bodies was uneconomic and placed an unnecessary burden on the steel industry. The price of manganese continued to decline steadily during 1929.

This résumé of the domestic manganese-ore industry through 1929 provides a perspective that is useful in viewing the events of the industry in 1930.

SUMMARY FOR 1930

Continuation, under the tariff act of 1930, of the duty of 1 cent per pound of contained manganese and its extension to cover ores containing as low as 10 per cent of manganese, probably constituted the most important event in the domestic manganese situation during 1930. The efforts of domestic producers to have an embargo placed on imports of manganese ore from Russia because of alleged dumping of ore and of its production by convict labor failed.

The year 1930 was characterized by falling prices, decreased consumption, decreased imports, and increased domestic production. Domestic production (shipments) of manganese ore (35 per cent or more of manganese) increased 11 per cent but was still insufficient for domestic requirements.

Domestic mines shipped 67,035 long tons of manganese ore (35 per cent or more of manganese), compared with 60,379 tons in 1929. Shipments of ferruginous manganese ore amounted to 77,417 tons, compared with 78,191 tons in 1929, and shipments of manganiferous iron ore amounted to 707,973 tons, compared with 1,110,067 tons in 1929. The production of ferromanganese decreased from 339,205 long tons in 1929 to 274,830 tons in 1930, and the production of spiegeleisen decreased from 137,143 long tons in 1929 to 87,059 tons in 1930.

Imports of manganese ore amounted to 585,568 long tons, compared with 664,269 tons in 1929.

From an international standpoint the continued development of the African manganese-ore deposits in the face of overproduction and active competition was the outstanding feature of the year. Among the developments of significance in Africa were (1) the completion of the railroad from Postmasburg to Koopmansfontein, South Africa; (2) the completion of the new wharf and loading facilities at Durban, South Africa; (3) the completion of the new ore-handling facilities at Takoradi Harbor, Gold Coast; and (4) the development of the deposits in Bou Arfa, Morocco. The increased production from Russia in spite of decreased world consumption and lowered prices was not without its effect upon the manganese situation.

DOMESTIC PRODUCTION

CLASSIFICATION OF MANGANESE-BEARING ORES

For the purpose of this report manganese-bearing ores produced in the United States have been divided into four main groups: (1) Metallurgical grade ores, under which have been classified manganese ores containing 35 per cent or more of manganese used in the manufacture of iron and steel, ferruginous manganese ore containing 10 to 35 per cent of manganese, manganiferous iron ore containing 5 to 10 per cent of manganese, and manganiferous zinc residuum; (2) battery ore; (3) fluxing ores, under which are classified ores that may contain a few ounces of silver and are rich enough in manganese to make them valuable chiefly for fluxing purposes in nonferrous smelters; and (4) miscellaneous ores, under which are classified the ores shipped to brick manufacturers, glass makers, and manufacturers of manganese chemicals.

The following table shows the production of manganese-bearing ores, according to this classification, for the last decade.

Manganiferous raw materials shipped in the United States, 1921–1930, in long tons

Year	Metallurgical ore [1]				Battery ore [2]	Miscellaneous manganese ore	Fluxing ore [3]
	Manganese ore (35 per cent or more of manganese)	Ferruginous manganese ore (10 to 35 per cent of manganese)	Manganiferous iron ore (5 to 10 per cent of manganese)	Manganiferous zinc residuum			
1921	[4] 2,300	8,439	62,670	12,627	11,231	(4)	25,990
1922	[4] 2,898	344,674	251,614	81,333	10,506	(4)	31,649
1923	[4] 11,060	319,666	1,072,457	132,801	20,440	(4)	42,543
1924	[4] 31,878	286,470	587,026	119,457	24,637	(4)	26,805
1925	[4] 76,173	267,252	1,153,268	147,937	22,151	(4)	27,534
1926	[4] 26,530	364,312	835,412	179,926	19,728	(4)	17,707
1927	[4] 27,730	148,291	1,310,127	184,771	17,011	(4)	3,190
1928	[4] 31,430	90,581	1,085,401	171,107	15,430	(4)	1,650
1929	[4] 47,597	78,191	1,110,067	168,363	12,782	(4)	----------
1930	53,326	77,417	707,973	113,060	11,757	1,952	----------

[1] Ferrous metallurgy only.

[2] Recorded as "chemical manganese ore" in earlier reports of this series.

[3] Nonferrous smelters.

[4] Small quantities of miscellaneous ore included with metallurgical ore.

METALLURGICAL MANGANESE ORE

Shipments of metallurgical manganese ore amounted to 53,326 long tons, valued at $971,515, in 1930. The 1930 total was derived from 11 States; Montana and Georgia furnished 78 per cent of the total, Montana contributing 43 per cent. The other 9 States (Arizona, Arkansas, California, Nevada, New Mexico, North Carolina, Tennessee, Texas, and Virginia) yielded quantities ranging from 60 tons in North Carolina to 3,276 tons in Arkansas. The following table shows the shipments of material of this class, by States, for the last decade.

Metallurgical manganese ore (exclusive of fluxing ore) shipped from mines in the United States, 1921–1930, by States, in long tons[1]

State	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Alabama			(2)	1,242	938	896	(2)	(2)		
Arizona	328	203	245	42	294	2,684	3,905	3,507	2,655	364
Arkansas	728	2,264	3,768	3,400	3,517	2,450	2,605	3,623	4,308	3,276
California		(2)	(2)	850	869	393			569	162
Colorado	490		2,278	5,338	743		(2)			
Georgia			1,502	1,093	1,649	3,251	489	4,727	2,521	18,897
Idaho						800	3,181	(2)	1,326	
Massachusetts					(2)					
Montana		45	2,376	11,933	55,659	5,713	10,124	12,044	29,945	22,731
Nevada		(2)		1,310	850	1,607	1,357			1,489
New Mexico			179	775	1,588	1,966	2,190	2,627	2,969	2,574
North Carolina					(2)	55		10		60
Oklahoma			(2)							
Tennessee	139	113	213	455	352	1,555	498	55	523	471
Texas									42	247
Utah					50		27		88	
Virginia	615		87	440	1,499	1,998	2,583	3,071	2,651	3,055
Washington				5,000	8,113	3,162				
Undistributed		273	412		52		771	1,766		
	2,300	2,898	11,060	31,878	76,173	26,530	27,730	31,430	47,597	53,326

[1] Includes small quantities of miscellaneous ore, 1921–1929.
[2] Included under "Undistributed."

FERRUGINOUS MANGANESE ORE

Shipments of ferruginous manganese ore amounted to 77,417 long tons, valued at $566,155, in 1930, compared with 78,191 tons, valued at $451,843, in 1929, a decrease of 1 per cent in quantity and an increase of 25 per cent in total value. Colorado, Arkansas, Georgia, Montana, and Utah were the principal producers of this class of ore in 1930, furnishing 87 per cent of the total; Colorado, the largest producing State, furnished 25 per cent. The increase in total value in 1930 is due largely to the greater production and the higher manganese content of the ores from Georgia. The shipments, by States, for the last decade follow.

Ferruginous manganese ore (exclusive of fluxing ore) shipped from mines in the United States, 1921–1930, by States, in long tons

State	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Alabama		475	694	611	298	1,018	(1)		475	321
Arizona						46	179	214	45	48
Arkansas	278		4,773	7,991	5,076	8,195	7,444	7,136	13,774	12,645
Colorado	924		18,348	27,058	7,352	2,925	26,828	18,599	17,770	19,730
Georgia	7,162	839	14,718	14,182	28,038	18,414	20,015	4,687	5,310	12,009
Idaho						351			38	1,450
Massachusetts					(1)	(1)	(1)			
Michigan	51	9,644	20,079	50,556	98,753	107,202	14,763	7,943	11,023	
Minnesota		305,093	253,634	159,915	77,665	158,759	6,276	3,487	5,421	4,698
Montana							10,332	11,156	15,665	11,875
Nevada				2,591	6,659	12,205	3,310		2,407	3,363
New Mexico		28,623	6,759	23,246	40,848	52,033	56,624	36,250		
Tennessee	24				(1)	953	487	718	241	113
Utah				116	666	(1)	239	286	5,942	10,972
Virginia			661	204	1,800	2,135	1,029	105	80	193
Undistributed					97	76	765			
	8,439	344,674	319,666	286,470	267,252	364,312	148,291	90,581	78,191	77,417

[1] Included under "Undistributed."

MANGANIFEROUS IRON ORE

Shipments of manganiferous iron ore amounted to 707,973 long tons, valued at $1,835,450, in 1930, compared with 1,110,067 tons, valued at $2,822,623, in 1929, a decrease of 36 per cent in quantity and 35 per cent in total value. Minnesota and New Mexico furnished all the ore of this class in 1930, Minnesota contributing 98 per cent of the total. During the last decade shipments, by States, were as follows:

Manganiferous iron ore (exclusive of fluxing ore) shipped from mines in the United States, 1921–1930, by States, in long tons

State	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Colorado				3, 891						
Georgia	6, 140	194	15, 530	6, 353	7, 349	6, 547	195			
Michigan			204, 700	39, 939			59, 976	41, 261	38, 089	
Minnesota	56, 530	248, 560	499, 181	361, 527	741, 409	799, 458	934, 599	1, 025, 014	1, 004, 420	693, 546
New Mexico						29, 407	30, 710	19, 081	67, 558	14, 427
Tennessee								45		
Utah					496					
Virginia							177			
Wisconsin		2, 860	353, 046	175, 316	404, 014		284, 470			
	62, 670	251, 614	1, 072, 457	587, 026	1, 153, 268	835, 412	1, 310, 127	1, 085, 401	1, 110, 067	707, 973

BATTERY ORE

Shipments of battery ore amounted to 11,757 long tons, valued at $432,668, in 1930, compared with 12,782 tons, valued at $576,158, in 1929, a decrease of 8 per cent in quantity and 25 per cent in total value. Shipments of ore of this class have declined steadily since 1924, due to imported ore and the newer developments in radio receiving sets. In 1930, as in 1929, 97 per cent of the domestic output came from Montana; the remainder came from Virginia. The shipments of battery ore, by States, for the past 10 years follow.

Battery ore[1] shipped from mines in the United States, 1921–1930, by States

Year	Idaho		Montana		Virginia		Total	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1921			11, 129	$441, 981	102	$6, 000	11, 231	$447, 981
1922			9, 706	(2)	800	(2)	10, 506	401, 965
1923			19, 540	646, 225	900	40, 000	20, 440	686, 225
1924			23, 512	816, 463	1, 125	50, 000	24, 637	866, 463
1925			20, 529	825, 970	1, 622	77, 000	22, 151	902, 970
1926	30	(2)	17, 904	(2)	1, 794	(2)	19, 728	848, 770
1927			16, 382	(2)	629	(2)	17, 011	705, 137
1928			14, 689	(2)	741	(2)	15, 430	621, 292
1929			12, 382	(2)	400	(2)	12, 782	576, 158
1930			11, 451	(2)	306	(2)	11, 757	432, 668

[1] Recorded as "chemical manganese ore" in earlier reports of this series.
[2] Bureau of Mines not at liberty to publish figures.

FLUXING ORE

Silver ores high in manganese are especially desirable in localities where nonferrous smelters must handle large quantities of "dry ores" because, as a flux, manganese is slightly more desirable than iron. Some ores high in silver yet containing a considerable percentage of manganese are valued chiefly for their silver content; such ores are classified as silver ores and are not reported in this chapter. Other ores containing only a few ounces of silver but a high percentage of manganese are valued chiefly for fluxing purposes and are referred to as fluxing ores. The shipments of fluxing ore, 1921 to 1930, are shown, by States, in the following table.

Fluxing ore shipped from mines in the United States, 1921-1930, in long tons[1]

Year	Colorado	Montana	Nevada	New Mexico	Year	Colorado	Montana	Nevada	New Mexico
1921	10,819		14,871	300	1925	11,366		16,168	
1922	13,951	8,934		8,764	1926	6,656		11,051	
1923	10,376	3,596	28,571		1927	1,029		2,161	
1924	4,488	5,607	16,710		1928	48		1,602	

[1] No fluxing ore shipped in 1929 and 1930.

REVIEW BY STATES

The following table shows the shipments of manganese-bearing ore in 1929 and 1930, by States.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1929 and 1930, by States

	Ore containing 35 per cent or more of manganese			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Shippers	Long tons	Value	Shippers	Long tons	Value	Shippers	Long tons	Value
1929									
Metallurgical (including miscellaneous):									
Alabama				3	475	$5,854			
Arizona	3	2,655	$27,826	1	45	181			
Arkansas	3	4,308	94,396	3	13,774	98,826			
California	4	569	8,099						
Colorado				2	17,770	(1)			
Georgia	2	2,521	(1)	7	5,310	57,432			
Idaho	3	1,326	13,707	1	38	239			
Michigan				1	11,023	43,541	2	38,089	(1)
Minnesota				1	5,421	24,991	5	1,004,420	$2,506,081
Montana	3	29,945	(1)	1	15,665	(1)			
Nevada				5	2,407	21,462			
New Mexico	3	2,969	50,173				1	67,558	(1)
Tennessee	3	523	12,425	3	241	1,810			
Texas	1	42	(1)						
Utah	2	88	(1)	2	5,942	(1)			
Virginia	[2] 7	2,651	52,577	2	80	810			
Undistributed			776,996			196,697			316,542
Total metallurgical (including miscellaneous)	34	47,597	1,036,199	32	78,191	451,843	8	1,110,067	2,822,623

[1] Included under "Undistributed."

[2] 1 producer in Virginia shipped both metallurgical and battery ore.

Manganese and manganiferous ore (exclusive of fluxing ore) shipped from mines in the United States, 1929 and 1930, by States—Continued

	Ore containing 35 per cent or more of manganese			Ore containing 10 to 35 per cent of manganese			Ore containing 5 to 10 per cent of manganese		
	Shippers	Long tons	Value	Shippers	Long tons	Value	Shippers	Long tons	Value
1929—Continued.									
Battery:									
Montana	[3] 2	12,382	$576,158						
Virginia	[2] 1	400							
Total battery	3	12,782	576,158						
	[4] 36	60,379	1,612,357	32	78,191	$451,843	8	1,110,067	$2,822,623
1930									
Metallurgical:									
Alabama				5	321	2,618			
Arizona	2	364	([1])	1	48	([1])			
Arkansas	4	3,276	58,172	3	12,645	96,964			
California	2	162	([1])						
Colorado				3	19,730	109,796			
Georgia	2	18,897	([1])	2	12,009	([1])			
Idaho				2	1,450	([1])			
Minnesota				1	4,698	17,837	5	693,546	1,794,334
Montana	[5] 2	22,731	([1])	2	11,875	([1])			
Nevada	1	1,489	17,617	2	3,363	([1])			
New Mexico	3	2,574	34,884				1	14,427	41,116
North Carolina	1	60	([1])						
Tennessee	[5] 2	471	([1])	1	113	([1])			
Texas	2	247	4,147						
Utah				3	10,972	91,742			
Virginia	[5] 4	3,055	56,791	2	193	1,560			
Undistributed			799,904			215,638			
Total metallurgical	25	53,326	971,515	27	77,417	566,155	6	707,973	1,835,450
Battery:									
Montana	[3][5] 2	11,451	432,668						
Virginia	[5] 1	306							
Total battery	3	11,757	432,668						
Miscellaneous:									
Montana	[5] 3	1,423	33,282						
Tennessee	[5] 1	37							
Virginia	[5] 2	492							
Total miscellaneous	6	1,952	33,282						
	27	67,035	1,437,465	27	77,417	566,155	6	707,973	1,835,450

[1] Included under "Undistributed."

[2] 1 producer in Virginia shipped both metallurgical and battery ore.

[3] Mills through which all ore was shipped; producers not counted.

[4] Revised figures.

[5] 1 producer in Montana, 1 in Tennessee, and 2 in Virginia shipped both metallurgical and miscellaneous ore; 1 producer in Virginia shipped both metallurgical and battery ore; and 1 producer in Montana shipped both battery and miscellaneous ore.

ALABAMA

During 1930 Alabama shipped 321 long tons of ferruginous manganese ore, valued at $2,618, compared with 475 tons, valued at $5,854, in 1929. About 57 per cent of the total came from Etowah County, where Gaston Scott, the largest shipper in the State, shipped several cars of ore averaging 28.92 per cent manganese, 2.57 per cent iron, and 16 per cent moisture. Other shipments were made from Calhoun and De Kalb Counties.

ARIZONA

Arizona shipped 364 long tons of manganese ore in 1930, compared with 2,655 tons in 1929. Most of the 1930 output came from the

Copper Queen mine in the Bisbee district, which produced ore containing (dried) 40.2 per cent manganese, 12.56 per cent iron, and 14.01 per cent silica; the remaining shipments came from the Black Warrior mine in Mohave County and averaged about 40 per cent manganese. A carload of ferruginous manganese ore, containing (dried) 34.1 per cent manganese, 14.25 per cent iron, and 12.66 per cent silica, was also shipped from the Copper Queen mine in 1930.

The manganese-ore deposits of Arizona have been described by Wilson and Butler.[3]

ARKANSAS

Shipments of manganese ore from Arkansas in 1930 amounted to 3,276 long tons, valued at $58,172, compared with 4,308 tons, valued at $94,396, in 1929. The ore shipped, most of which was in the form of mill concentrates, averaged about 45 per cent manganese (dried), with a fairly high content of iron and 4 to 10 per cent silica. Shipments of ferruginous manganese ore amounted to 12,645 tons, valued at $96,964, in 1930, compared with 13,774 tons, valued at $98,826, in 1929. The ferruginous manganese ore averaged 26 per cent manganese (dried) in 1930.

Walter H. Denison, the largest shipper of both classes of ore, operates in the Batesville-Cushman district. In addition to ore from his own property, Denison shipped a considerable tonnage purchased from a number of independent operators.

The Arkansas Manganese Ore Co. shipped a few cars of manganese ore averaging 45.82 per cent manganese, 7.13 per cent iron, 5.42 per cent silica, and 12.07 per cent moisture; it also shipped 1,307 tons of ferruginous manganese ore containing 24.03 per cent manganese, 17.37 per cent iron, 14.79 per cent silica, and 23.97 per cent moisture.

A. B. Reither shipped several hundred tons of manganese ore averaging 44.92 per cent manganese and more than 1,000 tons of ferruginous manganese ore averaging 30 per cent manganese from the Aydelotte mine near Cushman.

A small carload of manganese ore averaging 47.7 per cent manganese was shipped from a property near Caddo Gap, Montgomery County, in 1930.

CALIFORNIA

Shipments of manganese ore from California amounted to 162 long tons in 1930, compared with 569 tons in 1929. The Feather River mine in Plumas County about 5 miles from Crescent Mills and the Owl Holes mine in San Bernardino County were the only shippers in 1930.

COLORADO

No shipments of manganese ore were made from Colorado in 1930, but 19,730 long tons of ferruginous manganese ore, valued at $109,796, were shipped from the Leadville district, compared with 17,770 tons in 1929. The 1930 shipments averaged about 23 per cent manganese, 17 per cent iron, 8 per cent silica, and 18 per cent moisture.

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[3] Wilson, E. D., and Butler, G. M., Manganese-Ore Deposits in Arizona: Univ. of Arizona Bull. 127, 1930, pp. 1–104.

The Manganese Mines Co. of America plans to develop its property at Hall's Siding in Gunnison County.

GEORGIA

Shipments of manganese ore from Georgia amounted to 18,897 long tons in 1930, compared with 2,521 tons in 1929. Shipments of ferruginous manganese ore increased to 12,009 tons in 1930 from 5,310 tons in 1929. These increases were due largely to the activity of the Georgia Manganese & Iron Co., which was placed in receivership early in the third quarter of 1930. This company is involved in a reorganization that will include the Brunswick Terminal & Railway Securities Co., E. J. Lavino & Co., and Palmer & Co. After the reorganization it is planned to enter into an agreement with E. J. Lavino & Co., producers of ferromanganese, for exploration and operation of the mines.

IDAHO

No shipments of manganese ore were made from Idaho in 1930, but shipments of ferruginous manganese ore amounted to 1,450 long tons; 1,326 tons of manganese ore and 38 tons of ferruginous manganese ore were shipped in 1929. The ore as shipped in 1930 contained 33 per cent manganese. All the ore came from the Idaho Manganese and Vanzie mines in Bannock County.

MICHIGAN

No manganiferous ores were shipped from Michigan in 1930, but a total of 16,977 long tons was mined on the Menominee range.

MINNESOTA

Shipments of ferruginous manganese ore from Minnesota amounted to 4,698 long tons, valued at $17,837, in 1930, compared with 5,421 tons, valued at $24,991, in 1929. All this material came from the Louise and Merritt mines operated by the Manganiferous Iron Co. on the Cuyuna range and averaged 15 per cent manganese, 34 per cent iron, 10 per cent silica, and 10 per cent moisture.

Minnesota also shipped 693,546 tons of manganiferous iron ore, valued at $1,794,334, in 1930, compared with 1,004,420 tons, valued at $2,506,081, in 1929. The manganiferous iron ore averaged 7.5 per cent manganese and 38 per cent iron; it came from the Wearne mine (Inland Steel Co.), Milford mine (Amherst Mining Co.), Martin mine (Hanna Iron Ore Co.), Louise and Hillcrest mines (Manganiferous Iron Co.), Mahnomen mine (Cuyuna Ore Co.), and Sagamore mine (Sagamore Ore Mining Co.), all on the Cuyuna range.

The following table shows the shipments of ferruginous manganese and manganiferous iron ores from the Cuyuna range, by mines, from 1922 to 1930.

Ferruginous manganese and manganiferous iron ore shipped from the Cuyuna district, Minnesota, 1922–1930, in long tons

Mine	Ore containing 10 to 35 per cent manganese								
	1922	1923	1924	1925	1926	1927	1928	1929	1930
Cuyuna Mille Lacs (Louise)			12, 337	15, 896	158, 611	6, 276	[1] 3, 487	4, 129	2, 079
Hillcrest		430							
Hopkins			6, 190	19, 929					
Mahnomen	69, 644	74, 247	119, 781	41, 840					
Mangan, Nos. 1 and 2							(1)		
Merritt		[2] 24, 387			[3] 148			1, 292	2, 619
Portsmouth	38, 000								
Sagamore	197, 449	154, 570	21, 607						
	305, 093	253, 634	159, 915	77, 665	158, 759	6, 276	3, 487	5, 421	4, 698

Mine	Ore containing 5 to 10 per cent manganese								
	1922	1923	1924	1925	1926	1927	1928	1929	1930
Cuyuna Mille Lacs (Louise)			9, 737	165, 142	[4] 12, 046	218, 791	205, 103	110, 308	91, 948
Evergreen					6, 054		7, 881	74, 254	
Hillcrest	4, 100							105, 942	151, 978
Mahnomen	110, 590	282, 883	128, 967	206, 155	384, 753	374, 307	340, 630	218, 887	193, 879
Martin									1, 009
Merritt								4, 400	
Milford (Ida Mae)	870	77, 300		205, 050	202, 154	149, 034	161, 432	218, 928	98, 209
Portsmouth	133, 000	138, 998							
Sagamore			222, 823	165, 062	194, 451	192, 467	309, 968	271, 701	130, 172
Wearne									26, 351
	248, 560	499, 181	361, 527	741, 409	799, 458	934, 599	1, 025, 014	1, 004, 420	693, 546

[1] Mangan included under "Cuyuna Mille Lacs (Louise)" for 1928.
[2] According to the Lake Superior Iron Ore Association.
[3] According to Skillings' Mining Review.
[4] Includes sinter.

MONTANA

Shipments of metallurgical manganese ore from Montana in 1930 amounted to 22,731 long tons; they consisted of 8,124 tons of ore and 14,607 tons of sinter. The ore was derived from the Emma mine, and the sinter was produced from rhodochrosite mined at the Emma mine and treated in the plant of the Domestic Manganese & Development Co. at Butte. Although the Butte plant was shut down a large part of the year, it treated 23,938 long tons of rhodochrosite averaging 37.9 per cent manganese and recovered 14,595 tons of sinter averaging 57.6 per cent manganese.

Sinter made from rhodochrosite roasted by Domestic Manganese & Development Co., Butte, Mont., 1927–1930

Year	Rhodochrosite roasted		Sinter made		Manganese recovered from rhodochrosite (per cent)
	Long tons	Manganese (per cent)	Long tons	Manganese (per cent)	
1927	6, 430	37. 28	4, 114	55. 90	96
1928	18, 595	36. 63	11, 118	56. 45	92
1929	47, 025	37. 60	29, 041	57. 8	95
1930	23, 938	37. 9	14, 595	57. 6	93
	95, 988	37. 47	58, 868	57. 36	94

Shipments of battery ore in 1930, all from the Philipsburg district, amounted to 11,451 tons, compared with 12,382 tons in 1929.

In addition, a total of 11,875 tons of ferruginous manganese ore was shipped in 1930, compared with 15,665 tons in 1929. This material came from the Philipsburg district, where it is produced as a tailing in the treatment of ores to produce the high-grade ore used in battery manufacture.

During 1930 the Anaconda Copper Mining Co. demonstrated the feasibility of treating low-grade rhodochrosite ores by flotation. A large quantity of rhodochrosite ore in the Butte district carries some lead, zinc, gold, and silver and a relatively high amount of silica. Preliminary tests indicated that flotation could be applied successfully to this ore. Details of the process were perfected by the Anaconda Copper Mining Co. in a large-scale test conducted in a section of its zinc concentrator at Anaconda, Mont. Flotation was carried on in two stages; the first effected a separation of the metallic sulphides and the second a separation of the manganese carbonate from the silica. About 300 tons of ore were treated and about 200 tons of manganese concentrates were produced daily. The ore averaged 28 to 30 per cent manganese and over 20 per cent silica; the concentrates contained 38 to 40 per cent manganese and 5 to 7 per cent silica. Approximately 95 per cent of the manganese was recovered. A total of 12,000 tons of ore was treated during the test. The concentrates were shipped to the Domestic Manganese & Development Co. at Butte for nodulizing. The nodulized product ran approximately 60.8 to 62 per cent metallic manganese and 8 per cent silica, and it was sold to the Colorado Fuel & Iron Co. for the manufacture of ferromanganese.

NEVADA

Nevada shipped 1,489 long tons of manganese ore, valued at $17,617, in 1930; none was shipped in 1929. All the ore shipped in 1930 came from White Pine County; it averaged 44 per cent manganese (dried).

NEW MEXICO

Shipments of manganese ore from New Mexico amounted to 2,574 long tons, valued at $34,884, in 1930, compared with 2,969 tons, valued at $50,173, in 1929. The Manganese Valley Mines (Inc.), with mines in the Little Florida Mountains east of Deming, furnished 81 per cent of the 1930 shipments, although its properties were closed down part of the year. The ore shipped from the Manganese Valley mines in 1930 contained (dried) 45.88 per cent manganese, 3.46 per cent iron, and 5.48 per cent silica. The Luna Manganese Co., in the same district, began shipments in 1929 and continued to ship during 1930. Starkey & Perry shipped a small quantity of ore averaging 42.99 per cent manganese from a property in Grant County.

In 1930, as in 1929, no ferruginous manganese ore was shipped. Shipments of manganiferous iron ore, however, amounted to 14,427 tons in 1930, compared with 67,558 tons in 1929. This ore was mined by the Colorado Fuel & Iron Co. from the Kirchman property near Silver City and contained 9.75 per cent manganese, 26.4 per cent iron, and 4.98 per cent silica.

NORTH CAROLINA

Shipments of manganese ore from North Carolina amounted to 60 long tons in 1930; no shipments were reported for 1929. All the ore shipped came from the Interstate Ore & Metal Corporation's property near Murphy; it contained about 43 per cent manganese (dried).

SOUTH DAKOTA

No manganese-bearing ores were shipped from South Dakota in 1930. During the year it was reported that the General Manganese Corporation was building a mill and hydroelectric plant incident to the development of its manganese properties near Chamberlain.

TENNESSEE

Shipments of metallurgical manganese ore from Tennessee amounted to 471 long tons in 1930, compared with 523 tons in 1929. The ore in 1930 came from Carter County where the Roan Mining Co. operates the Cedar Hill and Valley Forge mines and from Bradley County where the Belmont Land & Mining Co. operates the Red Hill mine. The ore from the Cedar Hill mine contained (dried) 46.28 per cent manganese, 7.95 per cent iron, and 6.73 per cent silica; that from the Valley Forge mine contained 46.52 per cent manganese, 4.4 per cent iron, and 9.38 per cent silica; and that from the Red Hill mine contained 54 per cent manganese, 1.5 per cent iron, and 1.5 per cent silica.

Shipments of ferruginous manganese ore amounted to 113 tons in 1930, compared with 241 tons in 1929. All the ore shipped in 1930 came from the Blevins mine in Carter County; it contained 29.35 per cent manganese.

TEXAS

Shipments of manganese ore from Texas amounted to 247 long tons in 1930, compared with 42 tons in 1929. Walter Mayfield shipped 50 tons of ore containing (dried) 51 per cent manganese from the Chispa mine in Jeff Davis County. Thomas Venditto shipped 197 tons of ore containing (dried) 47.35 per cent manganese, 2 per cent iron, and 7 per cent silica from the Spiller mine in Mason County.

UTAH

No manganese ore was shipped from Utah in 1930. Shipments of ferruginous manganese ore increased to 10,972 long tons in 1930 from 5,942 tons in 1929. The ore averaged (dried) between 25 and 35 per cent manganese, with small amounts of iron. The largest shipper was the Black Boy mine at Lucerne, Juab County.

VIRGINIA

Shipments of metallurgical manganese ore from Virginia amounted to 3,055 long tons, valued at $56,791, in 1930. The largest shipper was the Hy-Grade Manganese Production & Sales Corporation, which operates the Mineral Ridge mine in Shenandoah County where a new mill of 30,000 tons annual capacity was put into operation early in 1930. The shipments from this property averaged (dried) 45 per cent manganese, 5 per cent iron, and 6 per cent silica. Other shippers of metallurgical-grade ore were the Flat Top mines in Bland County and the Eureka mine in Page County. The metallurgical ore from the Flat Top mines contained (dried) 45 to 47 per cent manganese, with a low iron and high silica content; the metallurgical ore from the Eureka mine ran (dried) 43.1 per cent manganese, with a low iron and high silica content.

Shipments of battery-grade ore from Virginia in 1930 totaled 306 tons, compared with 400 tons in 1929. All the shipments in 1930 came from the Mineral Ridge mine of the Hy-Grade Manganese Production & Sales Corporation.

Virginia also shipped 193 tons of ferruginous manganese ore, valued at $1,560, in 1930, compared with 80 tons, valued at $810, in 1929. The shipments in 1930 came from the Red Mountain mine in Augusta County and the Umbarger mine in Smyth County.

During the year it was reported that the Manganese Corporation of America had started development work on the Lucas tract near Leesville.

WASHINGTON

No manganese ore was shipped from Washington in 1930, but the Olympic Manganese Mining Co. continued development work on its properties at Iron Mountain. It was also reported that the company had taken over the old Tubal Cain mine in the eastern Olympic Mountains near Quilcene.

PORTO RICO[4]

The manganese ore produced in Porto Rico comes from the mine of the Porto Rico Ore Co. about 3 miles from Juana Diaz. The ore bodies consist of psilomelane and pyrolusite and occur near the surface as small irregularly shaped lenses in crystalline limestone. Mining methods are crude; the ore is carried by peons to a bin whence it is transported by cableway to a mill equipped with two jigs. From there, the washed ore is transported in wheelbarrows to the crusher, where it is crushed according to buyers' requirements. The concentrates, which are suitable for battery purposes, are shipped to Cleveland, Ohio. During 1930 about 2,500 tons were shipped to the United States. Porto Rican production of manganese ore is not included in the figures given in this report for United States production. Shipments of manganese ore from Porto Rico to the United States in the past five years were as follows:

Manganese ore shipped from Porto Rico to the United States, 1926–1930

Year	Long tons	Value	Year	Long tons	Value
1926	1,417	$41,518	1929	2,316	$83,646
1927	1,624	41,764	1930	2,536	84,691
1928	1,523	56,616			

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[4] Low, Bela, The Mineral Deposits of Porto Rico: Eng. and Min. Jour., vol. 128, No. 1, July 6, 1929, p. 5.

PRODUCERS OF DOMESTIC MANGANESE ORE

The following list comprises producers and shippers of domestic manganese ore (35 per cent or more of metallic manganese) in 1930.

Producers and shippers of manganese ore in 1930

- Arizona:
  - Black Warrior Mines Co. (out of business), Congress.
  - Phelps Dodge Corporation, Bisbee.
- Arkansas:
  - Arkansas Manganese Ore Co., Batesville.
  - Walter H. Denison, Cushman.
  - W. S. Harris, Caddo Gap.
  - A. B. Reither, Cushman.
- California:
  - J. A. Levensaler, 114 Sansome Street, San Francisco.
  - J. W. Wood, 247 Prospect Avenue, San Bernardino.
- Georgia:
  - Georgia Manganese & Iron Co., White.
  - J. T. Thomasson, Chattanooga, Tenn.
- Montana:
  - Anaconda Copper Mining Co., Butte.
  - Domestic Manganese & Development Co., Butte.
  - Moorlight Mining Co., Philipsburg.
  - Trout Mining Co., Philipsburg.
- Nevada:
  - Vietti & Caviglia, Ely.
- New Mexico:
  - Luna Manganese Co., Deming.
  - Manganese Valley Mines (Inc.), Deming.
  - Starkey & Perry, Deming.
- North Carolina:
  - Interstate Ore & Metal Corporation, 94 Beekman Street, New York, N. Y.
- Tennessee:
  - Belmont Land & Mining Co., Cohutta, Ga.
  - Roan Mining Co., Hampton.
- Texas:
  - Walter Mayfield, Valentine.
  - Thomas Venditto, Mason.
- Virginia:
  - Bruce & Horne Manganese Co., Crandon.
  - Hy-Grade Manganese Production & Sales Corporation, Woodstock.
  - D. W. Salyer, Crandon.
  - Stanley Manganese Mines, 1817 Thirty-seventh Street NW., Washington, D. C.

PRICE OF MANGANESE ORE

Prices for manganese ore according to grade and origin are quoted by various trade journals. Prices except for chemical ore are quoted on a per-unit basis, the unit being 1 per cent of a long ton, or 22.4 pounds, of metallic manganese. Prices for chemical-grade ore are quoted on a per-ton basis with a minimum requirement of manganese dioxide. According to Engineering and Mining Journal, prices fluctuated as follows during 1930:

Brazilian ore, containing a minimum of 47 per cent manganese, was quoted at 31 to 34 cents at the beginning of the year but dropped to 29 to 31 cents in February. Further declines brought the price to 25 cents in August, where it remained for the rest of the year.

Indian ore, containing a minimum of 47 per cent manganese, was quoted at 31 to 34 cents at the beginning of the year but declined to 27 to 28 cents in August and continued at that price for the rest of the year.

Caucasian ore, containing 53 to 55 per cent manganese, was quoted at 36 cents in January, dropped to 30 to 32 cents during February, was cut to 27 to 28 cents in August, and was quoted at that price for the rest of 1930.

Cuban ore, containing 47 per cent manganese, dropped from 35 cents in January to 32 cents in February. No lower quotations were published during the year.

Chilean ore, containing 47 per cent manganese, opened at 34 cents, dropped to 30 cents in May, and was quoted at 30½ cents for the rest of the year.

Prices on South African ore were quoted for the first time in June. Ore containing 52 to 54 per cent manganese was quoted at 28 to 29 cents but declined in August to 27 to 28 cents, where it remained for the rest of the year.

Domestic chemical ores, containing 70 to 72 per cent manganese dioxide, were quoted at $40 to $50 a long ton throughout the year.

Imported chemical ores, containing a minimum of 80 per cent manganese dioxide, were quoted at $60 to $65 a ton at the beginning of the year; the former figure held during most of the year.

IMPORTS OF MANGANESE ORE

Total imports of manganese ore in 1930 amounted to 585,568 long tons, containing 278,070 tons of manganese and valued at $6,476,802, compared with 664,269 tons, containing 323,415 tons of manganese and valued at $8,450,818, in 1929, a decrease of 12 per cent in quantity of ore. The decrease was caused by decreased consumption of high-grade manganese ore in the manufacture of ferromanganese, which in turn reflected the depressed condition of the iron and steel industry in 1930. The following table shows the imports of manganese ore into the United States for the last decade.

Manganese ore imported into the United States, 1921–1930

[General imports]

Year	Long tons	Value	Year	Long tons	Value
1921	[1] 392,606	[1] $2,864,099	1926	[2] 738,000	$11,071,131
1922	[2] 425,000	3,399,764	1927	622,067	8,487,016
1923	[2] 419,000	3,874,510	1928	427,708	5,395,949
1924	[2] 505,000	6,036,860	1929	664,269	8,450,818
1925	[2] 615,000	8,258,654	1930	585,568	6,476,802

[1] Exclusive of 8,748 tons, valued at $501,633, reported by Bureau of Foreign and Domestic Commerce as manganese ore. The value of this "ore" ranged from $46 to $128 a ton; consequently, the Bureau of Mines believes that the figures represent imports of ferromanganese, spiegeleisen, manganese chemicals, and perhaps some chemical ore.

[2] From Sept. 22, 1922, to Dec. 31, 1926, the Bureau of Foreign and Domestic Commerce reported only the manganese content of the manganese ore imported; since 1927 the bureau has reported also the gross weight of the ore. This figure is a Bureau of Mines estimate of the gross weight of ore imported.

Of the total manganese ore imported in 1930, 38.6 per cent came from Russia, 31.6 per cent from Brazil, 15.9 per cent from Gold Coast, and 9.9 per cent from India; together, these four countries accounted for 96 per cent of the total. Large decreases in imports are noted from the principal exporting nations with the exception of Gold Coast, imports from which increased from 33,593 tons in 1929 to 93,142 tons in 1930, or 177 per cent. The largest decrease, 103,448 tons, or more than 31 per cent, was in imports from Russia. Imports from Canada, one of the smaller sources, showed a large increase; however, this was probably due to transshipments from some other source. The following table shows the imports of manganese ore into the United States, by countries, from 1928 to 1930.

Manganese ore imported into the United States, 1928–1930, by countries

[General imports]

Country	Manganese ore (long tons)			Manganese content (long tons)			Value		
	1928	1929	1930	1928	1929	1930	1928	1929	1930
Brazil	142, 300	216, 535	185, 048	64, 290	93, 961	79, 849	$819, 615	$1,427,160	$1,484,039
Canada	3, 929	4, 804	15, 998	2, 234	2, 646	7, 706	101, 422	102, 975	343, 437
Chile	9, 340	2, 000	3, 485	4, 423	884	1, 544	118, 208	21, 000	33, 488
Cuba	3, 180	2, 667	2, 071	1, 556	1, 959	899	60, 402	32, 654	32, 317
Egypt	--------	101	--------	--------	58	--------	--------	4, 762	--------
Germany	133	1, 137	66	68	569	33	8, 007	34, 148	3, 583
Gold Coast	24, 186	33, 593	93, 142	11, 712	16, 058	44, 892	145, 059	366, 130	1, 253, 742
Greece	--------	--------	9	--------	--------	4	--------	--------	487
India (British)	83, 600	72, 940	58, 150	43, 072	37, 479	29, 989	1, 037, 942	968, 443	839, 621
Italy	--------	71	--------	--------	60	--------	--------	8, 933	--------
Java and Madura	1, 026	1, 000	1, 602	792	571	917	26, 580	25, 093	30, 906
Soviet Russia in Europe	159, 842	329, 336	225, 888	79, 529	169, 121	112, 174	3, 067, 259	5, 452, 366	2, 445, 871
Union of South Africa	5	--------	--------	3	--------	--------	73	--------	--------
United Kingdom	167	85	109	129	49	63	11, 382	7, 154	9, 311
	427, 708	664, 269	585, 568	207, 808	323, 415	278, 070	5, 395, 949	8, 450, 818	6, 476, 802

The following tables show the nationality of bottoms carrying manganese ore into the United States in the calendar years 1928 to 1930.

Nationality of bottoms carrying manganese ore into the United States and per cent of total carried by each, 1928–1930

Nationality of bottoms	1928	1929	1930	Nationality of bottoms	1928	1929	1930
United States	37. 2	29. 8	28. 9	Greek	2. 7	1. 2	15. 6
Brazilian	--------	. 6	--------	Italian	(1)	18. 4	8. 9
British	39. 4	41. 7	39. 1	Japanese	--------	2. 1	--------
Danish	3. 2	. 8	--------	Norwegian	2. 0	3. 1	5. 0
Dutch	. 4	(1)	. 3	Other [2]	1. 3	. 2	2. 0
French	7. 6	--------	--------				
German	6. 2	2. 1	. 2		100. 0	100. 0	100. 0

[1] Included under "Other."

[2] 1928: Honduran, Italian, Panaman, and Spanish; 1929: Dutch, Panaman, and Spanish; 1930: Honduran, Panaman, and Spanish.

Nationality of bottoms carrying manganese ore into the United States, 1928–1930, in long tons [1]

Country of origin	Flag	1928	1929	1930
Brazil	United States (Independent)	124, 950	156, 400	106, 000
	Brazilian	--------	4, 490	--------
	British	63, 200	84, 650	64, 702
	Norwegian	50	--------	--------
	Panaman	--------	--------	8, 900
		188, 200	245, 540	179, 602
Chile	United States (Independent)	1	2, 000	1, 550
	Norwegian	1, 401	--------	--------
	Panaman	6, 231	--------	1, 935
		7, 633	2, 000	3, 485
Honduras	United States (Independent)	--------	63	--------
	Honduran	--------	--------	63
	Norwegian	--------	--------	54
		--------	63	117

[1] Division of Statistics, Bureau of Research, U. S. Shipping Board, Special Report B. R. No. 1977, Sept. 16, 1931. Subject to revision. These figures include ore held in bonded warehouses and not classed as ore imported for consumption; they may include some ferruginous manganese or manganiferous iron ores. Probably some of the surplus over imports for consumption was reexported.

Nationality of bottoms carrying manganese ore into the United States, 1928–1930, in long tons—Continued

Country of origin	Flag	1928	1929	1930
Costa Rica	Norwegian	-------	95	
Cuba	United States (Independent)	384	610	91
	British	625	180	732
	Dutch	900		
	German	-------	110	1,191
	Honduran	-------	-------	22
	Norwegian	36	1,448	211
	Panaman	263	200	
		2,208	2,548	2,450
Jamaica	Honduran	70	-------	
Dominican Republic	British	40		
Scotland	do	-------	11	22
Belgium	United States (United States Shipping Board)	-------	21	
England	do	7,931	13,192	160
	United States (Independent)	11,033	6,440	3,600
	British	4,988	4,521	95
	Norwegian	-------	-------	24
		23,952	24,153	3,879
Greece	British	-------	-------	1,030
Norway	Danish	3,850	6,089	-------
	Norwegian	8,791	14,060	-------
		12,641	20,149	-------
Germany	United States (Independent)	-------	-------	180
	British	35	-------	-------
	German	61	74	73
		96	74	253
France	United States (United States Shipping Board)	93	135	-------
Italy	United States (Independent)	117	1,273	251
	Italian	151	383	2,710
	Norwegian	382	641	188
	Spanish	224	596	129
		874	2,893	3,278
Union of Soviet Socialist Republics (Black Sea)	United States (United States Shipping Board)	-------	-------	25,600
	United States (Independent)	-------	3,000	7,950
	British	51,663	153,175	16,300
	Danish	13,178	-------	-------
	French	39,675	-------	-------
	German	32,394	15,960	-------
	Greek	14,372	9,100	82,303
	Italian	-------	139,246	48,200
	Japanese	-------	16,000	-------
	Norwegian	-------	7,000	28,000
		151,282	343,481	208,353
Algeria	British	5,350	5,800	-------
Gold Coast	United States (Independent)	-------	5,099	7,203
	British	25,076	28,745	67,363
	Greek	-------	-------	7,146
		25,076	33,844	81,712
Tanganyika Territory	British	-------	98	-------
Nigeria	do	4	-------	-------
Egypt	do	-------	101	7,030
Australia	United States (United States Shipping Board)	4,500	4,279	-------
India	do	31,170	10,006	2,025
	United States (Independent)	14,250	23,750	11,000
	British	52,600	35,000	49,818
		98,020	68,756	62,843
Java	do	-------	533	-------
	Dutch	1,059	533	1,712
		1,059	1,066	1,712
Atlantic Canada	United States (Independent)	1,500	-------	-------
	British	3,536	4,419	16,473
		5,036	4,419	16,473

Nationality of bottoms carrying manganese ore into the United States, 1928-1930, in long tons—Continued

Country of origin	Flag	1928	1929	1930
Summary	United States (United States Shipping Board)	43, 694	27, 633	27, 785
	United States (Independent)	152, 235	198, 635	137, 825
	Brazilian	--------	4, 490	--------
	British	207, 117	317, 233	223, 565
	Danish	17, 028	6, 089	--------
	Dutch	1, 959	533	1, 712
	French	39, 675	--------	--------
	German	32, 455	16, 144	1, 264
	Greek	14, 372	9, 100	89, 449
	Honduran	70	--------	288
	Italian	151	139, 629	50, 910
	Japanese	--------	16, 000	--------
	Norwegian	10, 660	23, 244	28, 477
	Panaman	6, 494	200	10, 835
	Spanish	224	596	129
		526, 134	759, 526	572, 239

TARIFF

The only change in the manganese schedules under the tariff act of 1930 (effective June 18, 1930) was the extension of the duty to include ore containing 10 to 30 per cent manganese, which previously had been admitted free. The new clause covering manganese ore is as follows:

> PAR. 302: (a) Manganese ore (including ferruginous manganese ore, or concentrates, and manganiferous iron ore, all of the foregoing containing in excess of 10 per centum of metallic manganese, 1 cent per pound on the metallic manganese contained therein.

Late in 1930 the Government was requested to establish an embargo on imports of manganese ore from Russia on the ground that it was being dumped on the United States and that it was being produced by forced, indentured, or convict labor. The Secretary of the Treasury issued the following statement dated February 24, 1931, concerning the alleged dumping of manganese:

> Upon complaint of the American Manganese Producers Association, investigation has been made of allegations that manganese ore produced in the Soviet Republic of Georgia, U.S.S.R., has been and is being dumped on the United States market contrary to the provisions of the antidumping act of 1921.
>
> After an extended investigation and careful consideration of all the evidence presented by and on behalf of the parties in interest, I have reached the conclusion that a finding of dumping with respect to manganese ore imported from the Soviet Republic of Georgia, U.S.S.R., is not justified and must decline to issue such a finding.

No action was taken under section 307 of the tariff act of 1930 prohibiting the importation of convict-made goods.

CONSUMPTION OF MANGANIFEROUS RAW MATERIALS

The indicated consumption of manganiferous raw materials in the United States in 1929 and 1930 is shown in the following table. The table does not take into account the difference in consumers' stocks at the beginning and end of the year; such stocks would be largely imported ore, and inasmuch as the figure used in this table is "imports for consumption" it is thought that the change would not be great because manganese ore may be kept in bond until such time as it is needed for consumption, when the duty is paid and the ore becomes reported as "imports for consumption."

Indicated consumption of manganiferous raw materials in the United States, 1929 and 1930

	Ore containing 35 per cent or more manganese		Ore and residuum containing 10 to 35 per cent manganese		Ore containing 5 to 10 per cent manganese	
	Long tons	Manganese content (per cent)	Long tons	Manganese content (per cent)	Long tons	Manganese content (per cent)
1929						
Domestic shipments	[1] 62, 695	[2] 51	246, 554	16	1, 110, 067	7. 8
Imports for consumption	660, 558	48	[3] 116, 000	24	[3] 50, 000	6. 7
Total available for consumption	723, 253	48	362, 554	19	1, 160, 067	7. 7
1930						
Domestic shipments	[1] 68, 277	[2] 45	190, 477	17	707, 973	7. 5
Imports for consumption	454, 625	48	[3] 111, 000	23	[3] 50, 000	7. 1
Total available for consumption	522, 902	47	301, 477	19	757, 973	7. 5

[1] Includes shipments from Porto Rico.
[2] Partly estimated.
[3] Estimated.

Besides the material shown in the foregoing table, 997,000 long tons of iron ore containing 2 to 5 per cent manganese were presumably used in the manufacture of manganiferous pig iron in 1930, compared with 1,612,000 tons in 1929.

The manufacturing industries in the United States that consume manganese ore fall into three main groups: The ferrous-metallurgical industry, the battery industry, and miscellaneous industries. The first group consumes by far the largest amount, whereas the third group has little importance when the total consumption of manganese ore is considered but is of significance to the small producers of specialty ores.

The following is a list of some of the consumers of domestic manganese ores.

Consumers of domestic metallurgical manganese ore

Buckeye Steel Castings Co., Columbus, Ohio.
Colorado Fuel & Iron Co., Pueblo, Colo.
Columbia Steel Co., Ironton, Utah, and Torrance, Calif.
Lavino Furnace Co., Reusens, Va., and Marietta and Sheridan, Pa.
Ohio Ferro-Alloys Corporation, Philo, Ohio.
Pacific Coast Steel Corporation, Seattle, Wash.
Republic Steel Corporation, Birmingham, Ala.
Tennessee Coal, Iron & Railroad Co., Bessemer, Ala.
United States Pipe & Foundry Co., Chattanooga, Tenn.
United States Steel Corporation, Etna and Pittsburgh, Pa.

Consumers of domestic battery and miscellaneous manganese ore

Bond Electric Co., Jersey City, N. J.
Bright Star Battery Co., Hoboken, N. J.
Bunker Hill & Sullivan Mining & Smelting Co., Bradley, Idaho.

Burgess Battery Co., Freeport, Ill., and Niagara Falls, Ontario, Canada.
Carbon Products Co., Lancaster, Pa.
Carus Chemical Co., La Salle and Joliet, Ill.
Dominion Dry Battery Co., Toronto, Canada.
Evans-Wallower Zinc Co., East St. Louis, Ill.
Folsom Battery Co., Chicago, Ill.
French Battery Co., Madison, Wis.
Hudson Bay Mining Co., Flin Flon, Manitoba.
E. J. Lavino Co., Plymouth Meeting, Pa.
Marathon Battery Co., Wausau, Wis.
National Carbon Co., Cleveland and Fremont, Ohio, and San Francisco, Calif.
National Paint & Manganese Co., Lynchburg, Va.
St. Louis Sulphur & Chemical Co., St. Louis, Mo.
Sullivan Mining Co., Silver King, Idaho.
U. S. Electric Co., New York, N. Y.

FERROUS-METALLURGICAL INDUSTRY

Under present technology, manganese is indispensable in the manufacture of steel. It is used not only as a deoxidizer in steel manufacture but also as an alloying constituent because of certain properties it imparts to alloy steels. Manganese steels are utilized in the manufacture of steel plates, shapes, structural bars, open-hearth rails, spring steels, car wheels, tires, axles, armor-piercing projectiles, and armor plate and for many other purposes where toughness and resistance to abrasion are required. A new chromium-manganese alloy steel of particular interest because of its excellent physical properties has been described by Becket.[5]

The principal metallurgical use of manganese ore is in the manufacture of ferromanganese and spiegeleisen, the forms in which manganese is usually added to steel. A new development in steel manufacture is the application of manganese-silicon alloys to the deoxidation of steel.[6]

The following table shows critical data on manganese alloys imported into and produced in the United States.

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[5] Becket, F. M., Chromium-Manganese Steels: Am. Metal Market, vol. 37, No. 116, June 17, 1930, p. 10.

[6] Herty, C. H., jr., and Fitterer, G. R., New Manganese-Silicon Alloys for the Deoxidation of Steel: Rept. of Investigations 3081, Bureau of Mines, February, 1931, pp. 1–14.

Manganese alloys imported into and made from domestic and imported ores in the United States, 1924–1930, in long tons

	1924		1925		1926		1927		1928		1929		1930	
	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese	Alloy	Manganese
Ferromanganese:														
Imported	56,588	45,270	78,715	62,970	59,650	47,768	45,500	36,700	61,057	48,841	71,211	[illegible]	[illegible]	45,001
Domestic production	211,987	165,770	259,780	205,046	318,052	252,066	294,991	232,600	319,770	251,400	339,205	[illegible]	[illegible]	216,000
From domestic ore [1]	7,372	5,600	14,910	11,592	13,495	10,441	10,037	7,472	18,850	[illegible]	16,428	[illegible]	[illegible]	14,142
From imported ore [1]	204,615	160,170	244,870	193,454	304,557	241,625	284,954	225,128	300,920	[illegible]	322,777	256,944	[illegible]	201,858
Total	268,575	211,040	338,495	268,016	377,702	299,834	340,491	269,300	380,827	300,241	410,416	324,969	331,081	261,001
Ratio (per cent) of manganese in ferromanganese of domestic origin to total manganese in ferromanganese made and imported		2.7		4.3		3.48		2.77		4.67		4.01		5.42
Number of plants making ferromanganese	11		8		8		7		7		8		8	
Spiegeleisen:														
Imported	7,433	1,487	1,090	218	8,783	1,757	7,529	1,506	5,260	1,072	13,828	2,766	13,406	2,681
Domestic production	107,067	17,731	65,759	12,491	74,581	14,717	100,314	20,400	99,517	19,200	137,143	27,344	87,059	17,412
From domestic ore [1]	103,617	17,306	65,759	12,491	74,094	14,627	97,337	19,831	99,517	19,200	101,102	20,041	[illegible]	11,499
From imported ore [1]	3,450	425			487	90	2,977	569			36,041	7,303	[illegible]	5,913
Total	114,500	19,218	66,849	12,709	83,364	16,474	107,843	21,906	104,777	20,272	150,971	30,110	100,465	20,093
Ratio (per cent) of manganese in spiegeleisen of domestic origin to total manganese in spiegeleisen made and imported		90.1		98.3		88.79		90.53		94.71		66.56		57.23
Number of plants making spiegeleisen	6		2		2		5		4		6		[illegible]	
Total available supply of metallic manganese as alloys		230,264		280,725		316,308		291,206		320,499		355,079		281,094
Percentage of available supply of manganese in—														
Ferromanganese and spiegeleisen imported		20.3		22.5		15.66		13.02		15.57		16.78		16.97
Ferromanganese made from imported ore		69.6		68.9		76.39		77.41		74.09		71.88		71.81
Spiegeleisen made from imported ore		.2				.03		.19				2.06		2.10
Ferromanganese made from domestic ore		2.4		4.1		3.33		2.57		4.38		3.66		5.03
Spiegeleisen made from domestic ore		7.5		4.5		4.62		6.81		5.99		5.65		4.09
Ferromanganese and spiegeleisen made from domestic ore		9.9		8.6		7.95		9.38		10.37		9.29		9.12
Spiegeleisen made and imported		8.3		4.5		5.21		7.52		6.32		8.49		7.15
Total open-hearth and Bessemer steel	37,476,940		44,768,470		47,626,547		44,280,042		49,754,151		55,475,397		40,984,631	

[1] Partly estimated.

FERROMANGANESE

In 1930 the United States produced 274,830 long tons of ferromanganese, compared with an average of 318,000 tons for the preceding four years and with 339,205 tons in 1929, the record year in domestic ferromanganese production. The ferromanganese produced in 1930 contained about 216,000 tons of manganese (metal) or an average of 78.59 per cent manganese. The following table shows the production of ferromanganese during the last decade and the metalliferous materials consumed in its manufacture.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1921–1930

Year	Ferromanganese produced			Materials consumed (long tons)				Manganese ore used per ton of ferromanganese made (long tons)
	Long tons	Manganese contained		Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and scrap	
		Per cent	Long tons	Foreign [1]	Domestic			
1921	104, 129	76. 17	79, 319	208, 376	17, 839	143	2, 092	2. 172
1922	150, 010	78. 55	117, 836	335, 165	1, 804	------	5, 252	2. 246
1923	251, 938	78. 13	196, 844	538, 280	26, 790	498	6, 945	2. 243
1924	211, 965	78. 21	165, 776	443, 260	20, 133	909	4, 434	2. 186
1925	259, 780	78. 93	205, 046	519, 139	34, 942	4, 949	11, 072	2. 133
1926	318, 052	79. 25	252, 066	619, 898	36, 309	8, 064	5, 122	2. 063
1927	294, 991	78. 95	232, 900	564, 725	25, 298	12, 735	8, 570	2. 000
1928	319, 770	78. 62	251, 400	566, 859	37, 827	23, 159	8, 395	1. 891
1929	339, 205	79. 30	269, 000	614, 763	27, 558	47, 735	7, 811	1. 894
1930	274, 830	78. 59	216, 000	459, 478	32, 969	51, 039	9, 712	1. 792

[1] Includes Porto Rican ore.

In the production of ferromanganese in 1930 there were used 459,478 long tons of foreign manganese ore, 32,969 tons of domestic manganese ore, 40,501 tons of foreign ferruginous manganese ore, 10,538 tons of domestic iron ore, and 9,712 tons of cinder, scale, and scrap. Of the foreign manganese ore used in the manufacture of ferromanganese in 1930, Russia supplied the largest amount, 211,436 tons, and Brazil the next largest, 138,757 tons. These two countries supplied 76 per cent of the foreign ore consumed. The following table shows the foreign manganese ores, by countries of origin, consumed in the manufacture of ferromanganese from 1926 to 1930.

Foreign manganese ore used in manufacture of ferromanganese in the United States, 1926–1930, in long tons

Source of ore	1926	1927	1928	1929	1930
Africa	42, 692	41, 470	25, 039	28, 592	62, 913
Brazil	237, 358	245, 485	218, 181	228, 737	138, 757
Chile	5, 653	3, 746	5, 118	1, 187	1, 705
Cuba	18, 372	9, 408	14, 280	2, 050	------
India	31, 667	78, 548	96, 232	86, 547	44, 667
Russia	282, 954	184, 402	208, 009	267, 600	211, 436
Turkey	------	------	------	50	------
	618, 696	563, 059	566, 859	614, 763	459, 478

The quantity of manganese ore used per ton of ferromanganese made decreased steadily from 2.246 tons in 1922 to 1.891 tons in 1928, increased to 1.894 tons in 1929, and declined to 1.792 tons in 1930. The quantity of domestic manganese ore used represented 6.7 per cent of the total manganese ore used in the manufacture of ferromanganese in 1930.

Of the foreign ferruginous manganese ore used in the manufacture of ferromanganese in 1930 Brazil supplied 36,096 long tons, India 4,333 tons, and Sinai Peninsula (Egypt) 72 tons.

Ferromanganese was manufactured in the following plants in 1930.

Bethlehem Steel Co., Johnstown, Pa.
Lavino Furnace Co., Sheridan, Pa., and Reusens, Va.
Colorado Fuel & Iron Co., Pueblo, Colo.
Tennessee Coal, Iron & Railroad Co., Bessemer, Ala.
United States Steel Corporation, Etna and Pittsburgh, Pa.
Ohio Ferro-Alloys Corporation, Philo, Ohio.

The shipments of ferromanganese in 1930 amounted to 273,640 long tons, valued at $25,865,783, compared with 334,162 tons, valued at $33,184,012, in 1929. The trend of shipments during the last decade has been as follows:

Ferromanganese shipped from furnaces in the United States, 1921-1930

Year	Long tons	Value	Year	Long tons	Value
1921	[1] 111,374	$13,654,800	1926	330,070	$31,711,871
1922	[1] 161,612	10,673,638	1927	291,056	27,243,489
1923	226,365	23,853,313	1928	310,122	29,199,990
1924	[1] 232,821	23,533,668	1929	334,162	33,184,012
1925	[1] 254,005	26,006,439	1930	273,640	25,865,783

[1] Includes a small quantity of silicomanganese.

Although there is a slight export trade in ferromanganese the amount manufactured in the United States is insufficient for the country's requirements, so that the domestic supply must be augmented by imports from abroad. The imports of ferromanganese for consumption in the United States and the exports of ferromanganese and spiegeleisen, 1921 to 1930, are shown in the following table.

Ferromanganese imported into and exported from the United States, 1921-1930

Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value
1921	9,077	$888,419	690	$100,474
1922 Jan. 1-Sept. 21	72,136	6,125,469	[2] 1,107	[2] 76,822
1922 Sept. 22-Dec. 31	[1] 22,871			
1923	[1] 91,066	8,357,023	[3] 4,295	[3] 151,224
1924	[1] 45,270	3,844,474	[3] 3,165	[3] 92,421
1925	[1] 62,970	6,033,147	[3] 5,496	[3] 160,568
1926	[1] 47,768	4,410,142	[3] 663	[3] 44,111
1927	[1] 36,400	3,553,465	[3] 1,041	[3] 61,793
1928	[1] 48,844	4,899,374	[3] 9,440	[3] 232,990
1929	[1] 56,969	6,126,056	[3] 1,574	[3] 59,036
1930	[1] 45,001	4,128,065	[3] 6,189	[3] 145,629

[1] Figures prior to Sept. 22, 1922, represent gross weight of the ferromanganese but since that date represent the manganese content only.

[2] Also 289 tons of spiegeleisen, valued at $7,740; not separately classified for other years.

[3] Includes spiegeleisen; not separately classified after 1922.

The largest imports of ferromanganese in 1930 were from Canada and the next largest from the United Kingdom. The following table shows the sources from which ferromanganese was imported in 1929 and 1930.

Ferromanganese imported into the United States, 1929 and 1930, by countries

[General imports]

Country	1929		1930	
	Manganese content (long tons)	Value	Manganese content (long tons)	Value
Canada	27,474	$3,593,981	16,216	$2,016,293
France	516	73,929	170	30,320
Germany	100	6,713	324	24,279
Italy	2,096	330,480	1,023	159,771
Norway	18,743	1,702,579	7,458	789,662
Sweden	71	8,599		
United Kingdom	13,785	1,100,965	13,261	971,195
	62,785	6,817,246	38,452	3,991,520

The ports into which the imported ferromanganese entered in 1929 and 1930 were as follows:

Manganese content of ferromanganese imported into the United States, 1929 and 1930, by ports of entry, in long tons

[General imports]

Port of entry	1929	1930	Port of entry	1929	1930
Buffalo	18,486	10,522	Ohio	2,000	2,088
Galveston	59	58	Oregon		78
Los Angeles	1,925	1,354	Philadelphia	254	1,045
Maryland	17,561	12,865	San Francisco	2,362	2,104
Michigan	6,988	3,701	Washington (State)	561	322
New Orleans	10,103	3,141			
New York	2,486	1,174		62,785	38,452

TARIFF ON FERROMANGANESE

The rate on ferromanganese was unchanged in the tariff bill of 1930. The new schedules are as follows:

> PAR. 302: (*d*) Ferromanganese containing more than 1 per centum of carbon, 1⅞ cents per pound on the metallic manganese contained therein: *Provided*, That ferromanganese for the purposes of this Act shall be such iron manganese alloys as contain 30 per centum or more of manganese.
>
> (*e*) Manganese metal, manganese silicon, manganese boron, and ferromanganese and spiegeleisen containing not more than 1 per centum of carbon, 1⅞ cents per pound on the manganese contained therein and 15 per centum ad valorem.

PRICE OF FERROMANGANESE

The price of ferromanganese was somewhat lower in 1930 than in the two preceding years. The quotation at the end of the year was $89.79 per long ton of 80 per cent ferromanganese delivered at Pittsburgh. The trend of prices during the past six years is shown in the following table.

Prices per long ton of ferromanganese in the United States, 1925–1930 [1]

[80 per cent—delivered at Pittsburgh]

Month	1925	1926	1927	1928	1929	1930
January	$116.79	$119.79	$104.79	$104.79	$109.79	$104.79
February	119.79	119.79	104.79	104.79	109.79	103.79
March	119.79	102.29	104.79	104.79	109.79	103.79
April	119.79	92.79	104.79	104.79	109.79	103.79
May	119.79	92.79	98.54	108.19	109.79	103.79
June	119.79	92.79	94.79	109.79	109.79	103.79
July	119.79	92.79	94.79	109.79	109.79	103.79
August	119.79	92.79	94.79	109.79	109.79	103.79
September	119.79	92.79	94.79	109.79	109.79	103.79
October	119.79	99.79	94.79	109.79	109.79	103.79
November	119.79	104.79	94.79	109.79	109.79	103.79
December	119.79	104.79	103.42	109.79	104.79	89.79

[1] Steel, Vol. 88, Jan. 1, 1931.

SPIEGELEISEN

The production of spiegeleisen amounted to 87,059 long tons in 1930, compared with 137,143 tons in 1929. In 1930 the spiegeleisen produced contained about 20 per cent of manganese metal. The following table shows the production and shipments of spiegeleisen during the last decade.

Spiegeleisen produced and shipped in the United States, 1921–1930

Year	Produced (long tons)	Shipped from furnaces		Year	Produced (long tons)	Shipped from furnaces	
		Long tons	Value			Long tons	Value
1921	56,495	[1] 69,230	$2,838,692	1926	74,581	82,982	$2,016,088
1922	72,974	70,253	2,162,836	1927	100,314	80,892	1,986,188
1923	129,683	134,086	4,547,113	1928	99,517	116,911	2,802,108
1924	107,067	76,179	2,354,731	1929	137,143	123,146	3,336,703
1925	65,759	95,890	2,407,226	1930	87,059	94,918	2,469,861

[1] Includes a small quantity of silicospiegel.

Spiegeleisen was manufactured at the following plants in the United States in 1930.

Lavino Furnace Co., Sheridan, Pa., and Reusens, Va.
New Jersey Zinc Co., Palmerton, Pa.
United States Steel Corporation, Etna and Pittsburgh, Pa.

The imports of spiegeleisen for consumption amounted to 13,406 long tons in 1930, compared with 13,828 tons in 1929. The trend of spiegeleisen imports in the last decade is shown in the following table. Such figures as are available on exports of spiegeleisen are given on page 320.

Spiegeleisen imported for consumption in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	307	$10,472	1926	8,783	$256,714
1922 (Jan. 1–Sept. 21)	3,899	268,135	1927	7,529	220,979
1922 (Sept. 22–Dec. 31)	4,252		1928	5,260	147,406
1923	4,668	165,791	1929	13,828	403,853
1924	7,433	235,566	1930	13,406	381,197
1925	1,090	39,841			

The following table shows the trend in the price of spiegeleisen, by months, for the past six years.

Prices per long ton of spiegeleisen in the United States, 1925–1930[1]

[20 per cent—at producers' furnaces]

Month	1925	1926	1927	1928	1929	1930
January	$32.00	$34.00	$37.00	$32.00	$34.00	$34.00
February	33.00	34.00	37.00	32.00	34.00	34.00
March	33.00	34.00	37.00	32.00	34.00	34.00
April	33.00	34.00	37.00	32.00	34.00	34.00
May	33.00	34.00	35.50	32.00	34.00	34.00
June	32.00	34.00	34.80	32.00	34.00	34.00
July	31.50	34.00	34.00	33.00	34.00	33.00
August	32.25	34.00	33.35	33.00	33.20	33.00
September	33.00	34.00	33.00	33.00	33.50	33.00
October	33.00	34.00	30.15	33.00	34.00	33.00
November	34.00	38.75	30.00	33.00	34.00	33.00
December	34.00	37.00	31.00	34.00	34.00	33.00

[1] Steel: Vol. 88, Jan. 1, 1931.

MANGANIFEROUS PIG IRON

There is a growing practice in the United States of making manganiferous pig iron containing 2 to 10 per cent manganese. Under existing technology sufficient manganiferous iron ores are added to the blast-furnace charge to give the desired manganese content in the pig. As the charge must be maintained at a uniform manganese content it is usually made by mixing various grades of manganiferous iron ores. The manganiferous pig iron is converted into steel in open-hearth furnaces. Part of the manganese contained in the pig iron carries some of the objectionable impurities into the slag; the remainder is carried over as an alloying metal in the final steel product. There is, therefore, a considerable economy effected in the use of ferromanganese and spiegeleisen in the steel-making process.

Precise data on the consumption of manganiferous iron ores in the production of manganiferous pig iron are not available; however, in 1930, 707,973 long tons of ore containing 5 to 10 per cent manganese were shipped from domestic mines, and 50,000 tons of imported material of this grade were consumed. Also, 997,000 tons of domestic iron ore containing 2 to 5 per cent manganese were shipped. Import figures for iron ores containing 2 to 5 per cent manganese are not available.

BATTERY INDUSTRY

The shipments of manganese ore by domestic producers to battery makers in 1930 amounted to 11,757 long tons, and shipments from Porto Rico amounted to 1,242 tons. These figures indicate a consumption of 12,999 tons of domestic materials in battery manufacture. Imported manganese ore for which no figures are available was also consumed in the battery industry.

MISCELLANEOUS INDUSTRIES

Manganese ore is also consumed in the chemical, ceramic, and glass industries. Certain ores with peculiar physical or chemical properties are required for the manufacture of special articles in these industries. The domestic manganese ore shipped for these industries amounted to 1,952 long tons in 1930.

WORLD PRODUCTION

The following tables show the world production of manganese ores from 1926 to 1930, so far as statistics are available, and the average manganese content. Most of the figures are from official sources in the countries concerned, supplemented by data from semiofficial and other reliable sources.

Manganese ore produced in the principal countries, 1926–1930, in metric tons

[Prepared by L. M. Jones, of the Bureau of Mines]

Country [1]	Percentage of manganese	1926	1927	1928	1929	1930
North America:						
Canada (shipments)				349	278	248
Cuba	36–48	28, 091	812	2, 440	972	762
Mexico	40+	3, 299	861	661	249	303
United States—						
Continental (exclusive of fluxing ore)	35+	47, 000	45, 459	47, 612	61, 348	68, 111
Porto Rico [2]	35+	1, 440	1, 650	1, 547	2, 373	2, 577
South America:						
Argentina [3]		140	230	141	208	239
Brazil	38–50	260, 536	273, 494	359, 651	316, 172	206, 831
Chile [2]	40–50	11, 134	7, 688	9, 192	3, 104	6, 129
Uruguay [2]		39				(4)
Europe:						
Bulgaria	30–45	490	7			
Germany	30+	25	30	210	475	(4)
Great Britain	30+	130	1, 048	239		
Greece	30+	6, 348	8, 283	1, 080	1, 600	(4)
Hungary	30	9, 909	17, 272	22, 167	19, 044	9, 090
Italy	30–50	14, 010	9, 764	10, 274	9, 917	10, 633
Portugal	38–60		491			(4)
Rumania	42	8, 353	10, 369	31, 267	35, 038	33, 528
Russia [5]	41–48	1, 028, 607	843, 850	673, 398	1, 183, 880	1, 444, 166
Spain	29+	14, 947	36, 870	13, 704	17, 872	16, 819
Sweden	45+	15, 258	16, 823	15, 790	14, 609	8, 679
Yugoslavia	42–45	1, 244	1, 971	2, 660	3, 072	1, 539
Asia						
China [2]	50–55	42, 460	46, 350	43, 332	41, 881	54, 854
Cyprus			16			
India—						
British	47–52	1, 031, 218	1, 147, 479	994, 153	1, 010, 237	(4)
Portuguese [2]	42–46	3, 089	2, 414	4, 164	4, 948	(4)
Japan	50+	15, 209	27, 560	17, 693	18, 446	(4)
Netherland East Indies	45–56	11, 393	18, 503	24, 452	20, 997	17, 640
Portuguese East Indies (Timor)					3, 300	(4)
Turkey		77	11, 398	61	151	900
Africa:						
Algeria [2]		577	3, 817	1, 476	436	(4)
Egypt	30+	121, 868	152, 845	137, 502	191, 477	121, 211
Gold Coast [2]	50+	377, 284	409, 658	348, 755	465, 282	453, 773
Morocco (French) [2]	50	306	2, 696	2, 144	239	152
Northern Rhodesia	44–50		705	1, 821	1, 879	887
Tunisia	30–43	1, 550	2, 056	2, 200	200	
Union of South Africa	10–60	835	1, 300		9, 349	117, 321
Oceania						
Australia—						
New South Wales		1, 341	1, 221	170	237	127
Queensland	50±	20	236			
Victoria	50±		15			(4)
Western Australia [2]	47+	83	30		81	
New Caledonia [2]			130			
New Zealand [2]	52+		5			2
		3, 088, 000	3, 105, 000	2, 770, 000	3, 439, 000	(4)

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[1] In addition to the countries listed Belgium and Madagascar are reported to produce small quantities of manganese, but statistics of output are not available. Czechoslovakia and France report a production of "manganese ore," but as it has been ascertained that the product so reported averages less than 30 per cent of manganese and therefore would be considered ferruginous manganese ore under the classification used in this report the output has not been included in the table.

[2] Exports. [3] Shipments by rail and river. [4] Data not available. [5] Year ended Sept. 30.

Manganese ore produced in the principal countries, 1926–1930, in long tons

[Prepared by L. M. Jones, of the Bureau of Mines]

Country[1]	Percentage of manganese	1926	1927	1928	1929	1930
North America:						
Canada (shipments)	----------	----------	----------	344	269	244
Cuba	36–48	27,647	799	2,401	957	750
Mexico	40+	3,247	847	651	245	298
United States—						
Continental (exclusive of fluxing ore)	35+	46,258	44,741	46,860	60,379	67,035
Porto Rico[2]	35+	1,417	1,624	1,523	2,316	2,536
South America:						
Argentina[3]	----------	138	226	139	205	235
Brazil	38–50	256,420	269,174	353,970	311,178	203,564
Chile[2]	40–50	10,958	7,567	9,047	3,055	6,032
Uruguay[2]	----------	38	----------	----------	----------	(4)
Europe:						
Bulgaria	30–45	482	7	----------	----------	----------
Germany	30+	25	30	207	467	(4)
Great Britain	30+	128	1,031	235	----------	----------
Greece	30+	6,248	8,152	1,063	1,575	(4)
Hungary	30	9,753	16,999	21,817	18,743	8,946
Italy	30–50	13,789	9,610	10,112	9,760	10,465
Portugal	38–60	----------	483	----------	----------	(4)
Rumania	42	8,221	10,205	30,773	34,485	32,999
Russia[5]	41–48	1,012,365	830,526	662,765	1,165,187	1,421,363
Spain	29+	44,237	36,288	13,488	17,590	16,553
Sweden	45+	15,017	16,557	15,541	14,378	8,542
Yugoslavia	42–45	1,224	1,940	2,618	3,023	1,515
Asia:						
China[2]	50–55	41,790	45,619	42,648	41,219	53,988
Cyprus	----------	----------	16	----------	----------	----------
India—						
British	47–52	1,014,928	1,129,353	978,449	994,279	(4)
Portuguese[2]	42–46	3,040	2,376	4,098	4,870	(4)
Japan	50+	14,969	27,124	17,413	18,155	(4)
Netherland East Indies	45–56	11,213	18,211	24,066	20,665	17,361
Portuguese East Indies (Timor)	----------	----------	----------	----------	3,200	(4)
Turkey	----------	76	11,218	60	149	900
Africa:						
Algeria[2]	----------	568	3,757	1,453	443	(4)
Egypt	30+	119,944	150,432	135,331	188,454	119,297
Gold Coast[2]	50+	371,324	403,187	343,246	457,932	445,605
Morocco (French)[2]	50	301	2,653	2,110	235	150
Northern Rhodesia	41–50	----------	694	1,792	1,849	873
Tunisia	30–43	1,526	2,024	2,165	197	----------
Union of South Africa	40–60	821	1,279	----------	9,202	144,995
Oceania:						
Australia—						
New South Wales	----------	1,290	1,202	167	233	125
Queensland	50±	20	242	----------	----------	----------
Victoria	50±	----------	15	----------	----------	(4)
Western Australia[2]	47+	82	30	----------	80	----------
New Caledonia[2]	----------	----------	128	----------	----------	----------
New Zealand[2]	52+	----------	5	----------	----------	2
	----------	3,040,000	3,056,000	2,727,000	3,385,000	(4)

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[1] In addition to the countries listed Belgium and Madagascar are reported to produce small quantities of manganese, but statistics of annual output are not available. Czechoslovakia and France report a production of "manganese ore," but as it has been ascertained that the product so reported averages less than 30 per cent of manganese and therefore would be considered ferruginous manganese ore under the classification used in this report the output has not been included in the table.

[2] Exports.

[3] Shipments by rail and river.

[4] Data not available.

[5] Year ended Sept. 30.

RUSSIA

Russian production of manganese concentrates in the fiscal year ended September 30, 1930, amounted to the record total of 1,421,363 long tons, compared with 1,165,187 tons in the fiscal year 1929 and 1,225,611 tons in the calendar year 1913. Exports from Russia in the fiscal year 1930 amounted to 860,708 long tons, compared with

875,914 tons in the fiscal year 1929 and 1,174,916 tons in the calendar year 1913.

The Chiaturi deposits have been studied by Markov,[7] who estimates the reserve at 72,994,000 metric tons of crude ore which will yield 41,397,000 tons of concentrates having a manganese content of 50 to 53 per cent. The reserves at Nikopol have been estimated[8] recently by the geological committee of the U. S. S. R. at 83,000,000 metric tons of manganese ore in a mineralized zone 65 kilometers square. The committee further estimates a reserve of 1,000,000 tons in the region of Marulski, Achinsk, Siberia. It was reported[9] during the year that large deposits of manganese have been located about 125 miles north of Vladivostok near Olga Bay.

The Soviet Government in January, 1931, renewed its agreement[10] for the delivery of manganese ore to Rawack & Grünfeld A. G., of Berlin, whose contract had expired in September, 1930. Upon the expiration of the old contract the Soviet authorities attempted to sell the ore themselves but were unable to make sales on the scale achieved by the German concern. The new contract, which is said to provide for fixed prices and quantities, does not represent any basic change from the preceding one.[11]

The following quotation, concerning the cost of producing manganese ore in Russia, is taken from the Metal Bulletin.

RUSSIAN MANGANESE COSTS[12]

Some interesting figures of Soviet manganese mining costs are given by H. R. Knickerbocker (foreign correspondent of the New York Evening Post) in his book, "The Soviet Five-Year Plan and its Effect on World Trade," which describes his experiences and observations during an extensive tour last year of the principal undertakings of the plan in Russia. According to figures furnished by Karpe Modebadse, president of the Georgian Manganese Trust, and by Kalistrat Kamenzadashvilli, the vice president, the trust in 1930 was producing at a cost of 12 rubles 91 kopeks ($6.50 at par) per ton at the mines and 19 rubles 94 kopeks ($10) per ton at Poti. The average freight from Poti to Baltimore at that time was $3.50 per ton, making the c. i. f. Baltimore cost price to the Soviet $13.50 per ton. The manganese ore shipped usually averages 52 per cent Mn, but, allowing only 48 units at a market price of 30 cents per unit, the ore realized $14.40, showing a profit of 90 cents a ton, whilst if the full 52 per cent were calculated the profit would have been greater. It must be emphasized that in all these calculations the value of the ruble is taken as being par. The author affirmed that 30 cents per unit was actually being paid for Russian ore by the United States Steel Corporation and the Bethlehem Steel Corporation and stated that he had been shown copies of the contracts.

There remained the question of how the Georgian Manganese Trust could produce at 19 rubles 94 kopeks per ton (at Poti) when under the Harriman concession the cost was 27 rubles. The author points out, however, that the Harriman administration was handicapped by passive resistance on the part of the local labor force (which resistance is absent under Soviet control) and by strikes and other labor disturbances. Moreover, Harriman worked the mines only when the market was favorable for selling, although his labor costs continued irrespective of this. In addition, under the terms of the concession, it suited the concessionnaires for some purposes to return a high production cost.

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[7] Markov, K. V., The Chiaturi Manganese Deposits: Russia Geol. and Prospect. Service Trans. 27, 1931, pp. 1–41.

[8] Revista Minera, Metallurgica y de Ingenieria, Madrid, vol. 81, No. 3215, May, 1930, p. 212.

[9] Metal Bulletin (London), No. 1530, Sept. 30, 1930, p. 15.

[10] American Metal Market, Soviet Manganese Contract with Rawack & Grünfeld Renewed: Vol 38, No. 15, Jan. 22, 1931, p. 1.

[11] Metal Bulletin (London), No. 1564, Jan. 30, 1931, p. 15.

[12] Metal Bulletin (London), Russian Manganese Costs: No. 1593, May 19, 1931, p. 8.

During the term of the concession, other foreign owners, operating a few mines in the Chiaturi field, were able to deliver their manganese at Poti at a cost of 24 rubles per ton, say $12 at par. The author was of opinion that the figures supplied him were those used by the Soviet for their own bookkeeping.

Unless the Soviet has reduced its costs further, however, the position is now not so favorable, for although freights have fallen the price of Caucasian ore in America is now only about 26 cents per unit c. i. f. On this basis and last year's production costs, 48 per cent ore would realize only $12.48 c. i. f. against a cost price of $13.50, but 52 per cent ore would realize $13.52 or a profit of 2 cents per ton. In view of the general decline in the costs of production throughout the world, however, it is possible that the Soviet can now lay down ore at Poti for less than the equivalent of $10 per ton.

INDIA

India ranks second in manganese-ore production; from 1926 to 1929 its output averaged about 1,000,000 long tons per year. Data are not yet available on the 1930 production, but the decrease in exports in 1930 indicates a substantial decrease in production.

An important factor in the Indian manganese industry is the cost of transportation. A large part of the production comes from the Central Provinces and must be hauled long distances by rail to Bombay and Calcutta at considerable cost. The large increase in freight and terminal charges following the World War and the decrease in the price of manganese ore created an acute situation that was alleviated somewhat by a reduction in freight rates in 1928. Since that time, however, there has been a further decline in the price of manganese, and many mines have been forced to suspend operations in spite of improved rail facilities, such as the construction of the Tumsar-Tirody feeder line.

In October, 1929, a small reduction was obtained in the railway freight chargeable on second-grade ores, which previously could not be marketed in competition with Russian ores because of freight charges. Although the reduction was originally for only one year, it was extended during 1930 for another year.

To reduce transportation charges a railway which will shorten the rail haul considerably is being constructed from Rajpur to the port of Vizagapatam. The harbor at Vizagapatam is being improved to permit efficient loading of steamers.

Exports of manganese ore from British Indian ports, 1928 to 1930, by countries of destination, are shown in the following table.

Manganese ore exported from British Indian ports, 1928–1930, by countries, in long tons

Country	1928	1929	1930	Country	1928	1929	1930
Belgium	183, 897	181, 174	98, 205	United Kingdom	159, 227	264, 537	164, 895
France	195, 576	219, 055	208, 887	United States	76, 000	51, 250	54, 000
Germany	20, 945	12, 630	24, 360	Other countries	5, 946	10, 308	39, 982
Italy	9, 475	4, 246	620				
Netherlands	7, 501	36, 350	11, 500		658, 567	779, 550	602, 449

GOLD COAST

During the fiscal year ended March 31, 1930, the exports of manganese ore from Gold Coast amounted to 496,486 long tons, compared with 376,913 tons during the preceding fiscal year. At present there is only one manganese mine in Gold Coast, the Nsuta mine of the African Manganese Co. (Ltd.) at Nsuta, Western Province. The Nsuta mine is probably the largest manganese mine in the world. It is worked through opencuts, the excavation being effected by both hand labor and steam shovels. Most of the ore exported is used for metallurgical purposes, but some of the ore of better quality is used for chemical purposes. The ore is exported through the port of Takoradi, where a new loading plant was completed in February, 1930, at a cost of $500,000. The new loading plant has a capacity of 1,000 tons per hour, and provision has been made for doubling the capacity when needed. The plant is described in Mechanical Handling.[13]

BRAZIL

The production of manganese ore in Brazil in 1930 amounted to 203,564 long tons, compared with 311,178 tons in 1929, a decrease of about 35 per cent. The bulk of the output came from the Queluz and Burnier districts in the central part of the State of Minas Geraes. Production during October was curtailed because of the revolutionary movement.

The exports from Brazil amounted to 189,088 long tons in 1930, compared with 288,685 tons in 1929, a decrease of 99,597 tons or 35 per cent. The exports are made chiefly by the subsidiary of an American company which ships entirely to its own principals. The decreased activity in steel manufacture in the United States and the reduced prices for manganese were largely responsible for the curtailment of exports in 1930. Early in the year the State of Minas Geraes increased the export tax on manganese ore by increasing its valuation. The mining industry complained of this additional burden, and in April the State reverted to the old valuation.

The manganese industry in Brazil has been described by Teixeira.[14]

UNION OF SOUTH AFRICA

During 1930 the manganese deposits in the Postmasburg district of South Africa were brought into actual production on a commercial scale, when a total of 144,995 long tons was produced; in 1930 shipments of ore amounted to 52,296 tons.

The Postmasburg district is in the northern part of Cape Province about 108 miles west-northwest of Kimberley and about 65 miles northwest of the railhead of Koopmansfontein, from which a branch line has been built to serve the manganese area. At the end of the year the ore was being railed to Durban at the rate of 1,000 tons per day. At Congella, Durban, new wharves and loading facilities have been provided which permit the handling of ore at the rate of 500 tons per hour. Storage capacity of 50,000 tons has also been provided at this port.

The ore is of high grade, and the first shipments to industrial consuming centers have been favorably received. The ore is classified into three grades, the first class containing 51 per cent manganese, the second class 48 per cent manganese, and the third class 44 per cent manganese. The various grades can be recognized and segregated by the workers in the mine.

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[13] Mechanical Handling, Handling Manganese Ore: Vol. 18 (new series), No. 1, January, 1931, p. 27.

[14] Teixeira, Emilio, Manganese in Brazil: Eng. and Min. Jour., vol. 131, No. 8, Apr. 27, 1931, pp. 370–373.

The deposits were discovered in 1925 and have been under investigation since 1926. A succession of schemes for their exploitation has finally led to the acquisition of most of the deposits by the Manganese Corporation (Ltd.), which is controlled by the British-Swiss International Corporation (Ltd.). The Manganese Corporation (Ltd.) advanced the money for building the branch line from Koopmansfontein to Postmasburg and has guaranteed the South African Railways a minimum tonnage of 200,000 tons in 1931 and 350,000 tons in succeeding years. The corporation was granted certain exclusive rights for manganese traffic on the said railway and a special rate of 15s. 9d. per ton from Postmasburg to Durban. Although the mining freeholds and leases of the corporation extend over a belt about 40 miles in length, its operations have so far been confined to the farms of Beesthoek, Doornfontein, and Paling, approximately on the railroad, where large bodies of high-grade ore are being opened. The Manganese Corporation (Ltd.) has completed arrangements with the South African Manganese (Ltd.) and the Hay Base Metals (Prop.) (Ltd.) for the purchase of their ore at the rate of 120,000 tons per year.

Smelting works for the manufacture of ferromanganese and other ferro-alloys are proposed at Colenso where the Electrical Supply Commission has one of its large power stations.

It was reported [15] that new deposits of high-grade manganese ore have been discovered in Natal within 200 miles of Durban. The deposits are in crown land within 20 miles of the railway.

EGYPT

The production of manganese ore in Egypt amounted to 119,297 long tons in 1930, compared with 188,454 tons in 1929. Virtually all the manganese ore produced in Egypt comes from the mines of the Sinai Mining Co. (Ltd.) at Um Bogma on the Sinai Peninsula about 140 kilometers southeast of Suez. The ore is transported by aerial ropeway and train about 30 kilometers to the port of Abu Zenima on the west coast of Sinai.

The ore occurs very irregularly but is generally found in horizontal bedded deposits. Not only are the deposits irregular, but the ore varies greatly in relative quantities of iron and manganese so that the maintenance of uniform manganese content requires constant attention. The irregular occurrence of the ore necessitates many different working places at the same time and adds to the cost of mining. Extraction is accomplished by underground methods.

The ore, which is fairly high in combined metals, is relatively low in manganese, averaging 28 to 32 per cent and running as high as 35 per cent, but it is suitable for smelting when mixed with the minette ores of Alsace-Lorraine. The grade of ore, however, has been gradually reduced to 30 per cent, and material containing less than 30 per cent has been shipped to the United States. The cessation of imports into the United States from Egypt in 1930 may be due to the extension of the United States tariff to cover manganese ores containing 10 to 30 per cent manganese.

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[15] Mining Magazine (London), Manganese in Natal: Vol. 44, No. 4, April, 1931, p. 227.

MOROCCO

Exploitation of the Bou Arfa deposits in northeastern Morocco was begun upon the completion of the railway linking the deposits at Bou Arfa with Oudja. The mines at Bou Arfa can furnish two classes of high-grade metallurgical ore and also chemical ore of high dioxide content. The ore in sight at Bou Arfa is given as 1,000,000 tons. During the year a controversy arose as to whether Bou Arfa ore should be exported through the port of Saidia, Morocco, or through the port of Nemours, Algeria. It was finally decided in favor of Nemours, which is to be linked up by railroad to the Oudja line within a few years.

A large company was launched to exploit the deposits at Aoulouz, about 80 kilometers up the river from Taroudant, at the head of the Souss Valley. It was reported early in the year that this company would push work forward rapidly and perhaps build a narrow-gage railroad to the port of Agadir. A first shipment of 150 tons was later forwarded to France from Agadir. The deposit seems extensive but is not well developed as yet.

A new company known as Cie. Minière du Maroc has been founded by the Vincent group of Paris. The new company will have headquarters at Marrakesh and will be interested mainly in the exploitation of manganese deposits.

CUBA

The production of manganese ore in Cuba amounted to 750 long tons in 1930, compared with 957 tons in 1929 and 2,401 tons in 1928.

The Freeport Texas Co. has acquired a controlling interest in the Cuban American Manganese Corporation, owners of extensive manganese deposits in Cuba of which the most important comprise 10,000 acres in Oriente Province all within a 25-mile radius of Santiago. The deposits are practically on the surface, which will permit open-pit operations at low cost. Plans have been completed for the immediate erection in Cuba of a plant to treat 1,000 tons of ore a day by a new process of concentration. According to reports the plant will be capable of producing approximately 100,000 tons a year of material containing 50 per cent or more of metallic manganese. Production is expected within a year. Manganese ore can be shipped to the United States market free of duty under the commercial treaty made with Cuba in 1902.

CANADA

Canada shipped 244 long tons of manganese ore in 1930, compared with 269 tons in 1929 and 344 tons in 1928. Virtually all the production came from Turtle Creek, Albert County, New Brunswick; a small shipment (4 tons) for experimental purposes was made from a property in Lunenburg County, Nova Scotia.

It was reported[16] during the year that K. A. MacPhayden had acquired control of a property 20 miles from Moncton, New Brunswick, upon which a manganese discovery was made late in 1929. Up to October, 1930, about five carloads had been shipped from an open pit in which a 9-foot face of ore was exposed. Diamond drilling and other development work were done in 1930 to determine the size of the deposit, but so far there have been no estimates of reserves.

Near the end of 1930 a shipment of about 3,000 tons of Russian manganese ore was imported through Montreal and was probably transshipped to mid-western destinations in Canada and the United States. This was the first shipment of manganese ore to Canada from Russia; previously, manganese ore had been brought in from West Africa.

PALESTINE

Manganese deposits are reported[17] to have been located in southern Palestine in the Akaba district near the Gulf of Akaba. The ore appears to be of exportable value, and concessions are said to have been granted to an English concern.

MANGANESE ORE IMPORTED INTO MAIN CONSUMING NATIONS

The following table shows the imports of manganese ore into the leading steel-manufacturing nations and the indicated source of the ore.

Manganese ore imported into the principal consuming countries, 1926-1930, by countries from which imported, in long tons

Importing country	Country from which imported	1926	1927	1928	1929	1930	Source of information
Belgium-Luxemburg Economic Union.	Brazil	2,076		37,752	18,263	1,551	Official trade returns.
	British India	154,031	94,857	122,977	149,868	117,198	
	Egypt	26,498	980			(a)	
	Portuguese India	4,486		12,611	19,270	17,895	
	Russia	65,819	75,183	68,254	87,610	64,524	
	Other countries	11,484	94,090	21,333	48,466	54,375	
		264,394	265,110	262,927	323,477	255,543	
France	Brazil	12,482	22,174	42,489	70,532	16,428	Commerce Extérieur de la France.
	British India	239,541	257,077	262,877	272,512	280,717	
	British West Africa	37,074	31,984	77,203	101,107	82,551	
	Russia	90,534	77,508	108,667	181,132	189,021	
	Spain	47,880	40,546	13,031	18,969	24,707	
	Other countries of Asia	40,531	34,979	41,793	36,294	12,721	
	Other countries	132,961	184,904	180,511	107,050	93,176	
		601,003	649,172	726,571	787,596	699,321	
Germany	Brazil	5,977	2,529	27,372	3,617	523	Official German trade statistics.
	British India	46,536	75,431	124,594	128,485	77,116	
	British West Africa	6,511	(a)	(a)	(a)	328	
	Dutch East Indies	4,206	6,133	12,567	7,765	3,749	
	Egypt	17,054	46,092	29,489	35,044	17,208	
	Russia in Europe	58,420	(a)	(a)	(a)	170,921	
	Russia in Asia	33,058	207,312	71,060	175,933		
	Other countries	24,208	29,567	14,669	30,421	60,233	
		195,970	367,064	279,751	381,265	330,078	

[a] Included under "Other countries."

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[16] Skillings' Mining Review, Manganese from New Brunswick: Vol. 19, No. 17, Aug. 30, 1930, p. 9.

[17] Metal Bulletin (London), No. 1559, Jan. 13, 1931, p. 15.

Manganese ore imported into the principal consuming countries, 1926–1930, by countries from which imported, in long tons—Continued

Importing country	Country from which imported	1926	1927	1928	1929	1930	Source of information
Great Britain	British countries:						Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions
	British India	81,710	176,757	175,378	259,260	(b)	
	Gold Coast	20,844	505	1,319	1,380	(b)	
	Other British countries	56	130	1,500	190	(b)	
		102,610	177,392	178,197	260,830	(b)	
	Foreign countries:						
	Brazil		1	8,010		(b)	
	Japan and possessions					(b)	
	Java		1,973	1,998	1,361	(b)	
	Netherlands	96	197	583	629	(b)	
	Portuguese possessions in India.	6,387		13,005	11,256	(b)	
	Russia	32,101	13,061	1,750	10,046	(b)	
	Spain		3,291		2,289	(b)	
	Other foreign countries	3,114	2,612	2,422	2,942	(b)	
		41,698	21,135	27,768	28,523	(b)	
		144,308	198,527	205,965	289,353	222,444	
Netherlands	Belgium	58					Maandstatistiek van den in-uit en Doorvoer.
	Dutch East Indies	1,361	1,212	1,895	1,231	1,336	
	Egypt			3,200	6,339		
	France	438	453	257	639	464	
	Germany	179	225	316	289	548	
	Italy (Fiume)	386					
	Norway	140					
	Russia in Europe		3,961	300	4,618		
	Other countries	2	803	54	325	368	
		2,564	6,654	6,022	13,441	2,716	
United States	Africa (British):						Foreign Commerce and Navigation of the United States.
	South	12,946		5			
	West	100,614	87,230	24,186	33,593	93,142	
	Brazil	272,287	174,026	142,300	216,535	185,048	
	British India	63,742	93,017	83,600	72,940	58,150	
	Canada	417	430	3,929	4,804	15,998	
	Chile	8,213	3,206	9,340	2,000	3,485	
	Cuba	14,112	8,976	3,180	2,667	2,071	
	Egypt				101		
	Germany	150	65	133	1,137	66	
	Italy	6,083			71		
	Java and Madura	594	1,527	1,026	1,000	1,602	
	Netherlands	25					
	Norway	3,542					
	Russia in Europe	254,885	253,544	159,842	329,336	225,888	
	United Kingdom	206	46	167	85	109	
	Other countries					9	
		737,816	622,067	427,708	664,269	585,568	

[b] Information not available.

SECONDARY METALS[1]

By J. P. Dunlop[2]

CONTENTS

	Page		Page
Introduction	333	Secondary copper	344
Scope of report	333	Secondary lead	345
Recovery, treatment, and use of waste material	333	Secondary zinc	346
Classification of old metals	335	Secondary tin	348
Review of the secondary metal industry in 1930	339	Secondary antimony	350
Market conditions	339	Secondary aluminum	351
Prices of some scrap metals and alloys	340	Secondary nickel	353
Secondary metals recovered	342		

INTRODUCTION

SCOPE OF REPORT

"Secondary metals" are those recovered from scrap metal, sweepings, skimmings, and drosses and are so called to distinguish them from metals derived directly from ores, which are termed "primary metals." The distinction does not imply that secondary metals are of inferior quality, for metals derived either from ore or from waste material vary in purity and in adaptability to use in making certain products. The figures furnished by producers cover seven metals—secondary copper, zinc, lead, tin, antimony, aluminum, and nickel—and supplement those on the primary metals. They are given to enable producers and consumers to form a more comprehensive idea of the quantities of metal available for consumption; in fact, they constitute an essential addition to the figures given in the general reports on the primary metals and will become more essential in the future.

"Secondary metal" was very aptly defined at the February, 1928, meeting of the American Institute of Mining and Metallurgical Engineers "as that which had lost its original identity as to source."

RECOVERY, TREATMENT, AND USE OF WASTE MATERIAL

The collection of waste material is a long-established branch of industry now vital as an important source of supply of many products. It involves the collection, sorting, and shipment of waste having an estimated value exceeding a billion dollars a year. This report covers less than one-third of the value and only a small percentage of the total quantity of waste materials that are marketed. There is an imposing variety of wastes, and these wastes are segregated into many classes so as to make them available for different uses. Perusal of trade papers devoted to waste material discloses an active trade by buyers and sellers of hundreds of different wastes. In fact there appears to be a use for nearly all waste material salable at a price that will meet the expenses of collection, conditioning, and marketing. A large part of the wastes in rural sections can not be, and is not, collected, as the cost of collecting and the freight to points of consumption are more than the gross cash return, especially for metal wastes at prices prevailing in 1930.

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[1] Work on manuscript completed August, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

An article[3] by Thomas A. Wright states—

> Prejudice still is all too widespread against the use of alloys, for working, casting, soldering, etc., made wholly or in part from secondaries. Nevertheless, the prejudice is being broken down and more and more the engineer (and even the fellow metallurgist) is coming to realize that alloys or metals of virgin origin are not necessarily a guaranty of successful application.
>
> Even a virgin metal must needs have passed through a refining process, and the effects of the presence of the original impurities often are more to be guarded against than of those common to secondary metal. An impurity is an element in the wrong place or combination. Sometimes, that which we call an impurity may perhaps be beneficial; increased recognition of this fact (and instances and examples are accumulating) should in turn work for still more economic handling of recovered metals.

The Institute of Scrap Iron and Steel (Inc.) functions through 13 chapters in the principal steel centers of the country and through 7 service bureaus. The chapters are in Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Jersey City, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, and Seattle.

The institute's activities include the following: Trade relations, arbitration, traffic, research, credit, trade promotion, and insurance.

With the cooperation of the Federal Trade Commission the institute has adopted the Code of Business Practices which has for its aim the shipment of scrap to consumers in accordance with agreed specifications and the elimination of unfair and unethical practices in the industry. During 1930, 50 complaints involving violations of the Code of Business Practices were heard by the trade relations committee. Through the procedure of compulsory arbitration for its members the institute has adjudicated more than 100 commercial disputes between scrap-iron dealers.

The institute has embarked on a program to counteract "direct dealing" between producer and consumer of scrap to demonstrate to the steel industry that the elimination of the scrap-iron dealer through "direct dealing" will destroy normal scrap markets, prevent the collection and preparation of millions of tons of scrap annually, create a drain on the iron-ore reserves of the country, and ultimately raise the price of scrap.

As part of its trade-promotion work the institute is trying to create wider markets and uses for scrap. Among its plans in this connection is a program to scrap 3,000,000 old automobiles annually through the machinery of the scrap-iron industry, in cooperation with the leading automobile manufacturers. The institute also plans to conduct an intensive study of the problems of alloy steel scrap for which the widest markets have not yet been found.

The advent of lower prices for commodities and the decreased demand for manufactured products have stimulated efforts to save material and reduce costs of production. Nationally increased attention has been directed to the salvage use or sale of wastes. As an indication of such tendencies the following list of articles recently published is given:

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[3] Wright, T. A., Secondary Metals: Metal Ind., January, 1931, pp. 11–13.

Clamer, G. H., The Romance of the Reclamation of Metals (A Radio Address on Secondary Metals Describing Their Origin, History, and Development Into a Large Industry): Metal Ind., February, 1931, pp. 75–76.

Gee, D. W., Disposition of Factory By-Products: Nat. Waste Rev., June, 1931, pp. 39–41.

Huber, F. W., Training Men to Prevent Waste: Nat. Waste Rev., October, 1930, pp. 49–51.

McKnight, C. H., Segregation and Control of Waste: Nat. Waste Rev., April, 1931, pp. 39–42.

Phillips, R. W., The Relation of Salvage and Reclamation to Costs of Finished Products: Nat. Waste Rev., November, 1930, pp. 45–47.

Wright, T. A., The Relationship Between the Business and the Technical Phases of Salvage and Its Disposal: Nat. Waste Rev., January, 1931, pp. 45–46.

The twenty-fifth anniversary number of the Waste Trade Journal, dated December 6, 1930, traces the progress of the waste-material industry in its many phases and bewildering variety. The history is interesting to the trade, and it is also instructive to those outside the industry in that they can form some idea of how nearly every kind of business is affected by the reuse of old materials. Among the many articles published in that issue are the following:

Clamer, G. H., Chemistry Played Great Part in Advancing Non-Ferrous Ingot Industry, pp. 101, 109, and 113.

Rubin, A., Progress of Secondary Aluminum Industry, p. 79.

Spitzer, Oscar, Scrap Metal Gains Due to Primary Smelters, pp. 29–33.

Wilson, L. T., Urge Scrap Metal Trade to Acquire Technical Knowledge of Metals, p. 31.

Wright, T. A., Scrap Metal Trade Must Use Chemist to Progress, pp. 159 and 161.

The earlier chapters on Secondary Metals in Mineral Resources contain much information regarding the collection of waste material and many references to articles published about smelting and refining nonferrous waste. Various trade papers, such as the Waste Trade Journal, Daily Metal Trade, Brass World, American Metal Market, Foundry, Iron Age, Iron Trade Review, Metal Industry, Salvage, National Waste Review, Metal and Mineral Markets, and Daily Metal Reporter, also contain valuable information relating to prices and marketing of scrap metal and drosses and technical information relating to the proper use of old metals.[4]

CLASSIFICATION OF OLD METALS

The classification of old metals drawn up by the metal division of the National Association of Waste Material Dealers (Inc.), Times Building, New York, N. Y., and changed from time to time as desirable is the standard of both dealers and manufacturers in the United States. The latest classification (Circular L), effective March 13, 1930, follows. It has been changed slightly, and new committees have been appointed to consider other changes in the classification, particularly those relating to aluminum. Attention is directed to items 1 (*a*), 4, and 19, which show changes in the specifications relating to deliveries, heavy copper, and auto radiators.

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[4] Metal Industry, Value of a Business Publication: July, 1926, p. 290.

Standard Classification for Old Metals, Effective from March 13, 1930

1. *Delivery.*—(*a*) Delivery of more or less of the specified quantity up to 1¼ per cent is permissible.

(*b*) If the term "about" is used, it is understood that 5 per cent more or less of the quantity may be delivered.

(*c*) Should the seller fail to make deliveries as specified in the contract, the purchaser has the option of canceling all of the uncompleted deliveries or holding the seller for whatever damages the purchaser may sustain through failure to deliver, and if unable to agree on the amount of damages an arbitration committee of the National Association of Waste Material Dealers (Inc.), appointed for this purpose, to determine the amount of such damages.

(*d*) In the event that buyer should claim the goods delivered on a contract are not up to the proper standard, and the seller claims that they are a proper delivery, the dispute shall be referred to an arbitration committee of the National Association of Waste Material Dealers (Inc.), to be appointed for that purpose.

(*e*) A carload, unless otherwise designated, shall consist of the weight governing the minimum carload weight at the lowest carload rate of freight in the territory in which the seller is located. If destination of material requires a greater carload minimum weight, buyer must so specify.

(*f*) A ton shall be understood to be 2,000 pounds unless otherwise specified. On material purchased for direct foreign shipment a ton shall be understood to be a gross ton of 2,240 pounds unless otherwise specified.

(*g*) If, through embargo, a delivery can not be made at the time specified, the contract shall remain valid and shall be completed immediately on the lifting of the embargo, and terms of said contract shall not be changed.

(*g*-1) When shipments for export for which space has been engaged have been delivered or tendered to a steamship for forwarding and through inadequacy of cargo space the steamship can not accept the shipment, or where steamer is delayed in sailing beyond its scheduled time, shipment on the next steamer from the port of shipment shall be deemed a compliance with the contract as to time of shipment.

(*h*) In case of a difference in weight and the seller is not willing to accept buyer's weights, a sworn public weigher shall be employed, and the party most in error must pay the costs of handling and reweighing.

(*i*) When material is such that it may be sorted by hand, consignees can not reject the entire shipment if the percentage of rejection does not exceed 10 per cent. The disposition of the rejected material should then be arranged by negotiations; no replacement of the rejected material to be made.

Upon request of the shipper, rejections shall be returnable to the seller on domestic shipments within one week and on foreign shipments within 30 days from the time notice of rejection is received by them, and upon payment by them of 1 cent a pound on material rejected to cover cost of sorting and packing; the seller to be responsible for freight both ways.

2. *No. 1 copper wire.*—To consist of clean untinned copper wire not smaller than No. 16 B. & S. Wire gauge to be free from burnt copper wire which is brittle and all foreign substances.

3. *No. 2 copper wire.*—To consist of miscellaneous clean copper wire which may contain a percentage of tinned wire and soldered ends but to be free of hair wire and burnt wire which is brittle; the tinned wire not to be over 15 per cent of the total weight.

4. *No. 1 heavy copper.*—This shall consist of untinned copper not less than 1/16 inch thick, and may include trolley wire, heavy field wire, heavy armature wire, that is not tangled, and also new untinned and clean copper clippings and punchings, and copper segments that are clean.

5. *Mixed heavy copper.*—May consist of tinned and untinned copper, consisting of copper clippings, clean copper pipe and tubing, copper wire free of hair wire and burnt and brittle wire, free from nickel-plated material.

6. *Light copper.*—May consist of the bottoms of kettles and boilers, bathtub linings, hair wire, burnt copper wire which is brittle, roofing copper and similar copper, free from radiators, brass, lead and solder connections, readily removable iron, old electrotype shells, and free of excessive paint, tar, and scale.

7. *Composition or red brass.*—May consist of red scrap brass, valves, machinery bearings and other parts of machinery, including miscellaneous castings made of copper, tin, zinc and/or lead, no piece to measure more than 12 inches over any one part or to weigh over 60 pounds, to be free of railroad boxes and other similarly excessively leaded material, cocks and faucets, gates, pot pieces, ingots, and burned brass, aluminum composition, manganese, and iron.

8. *Railroad bearing.*—Shall consist of railroad boxes or car journal bearings, must be old standard used scrap, free of yellow boxes, also iron-backed boxes, and must be free of babbitt, also free of excessive grease and dirt.

9. *Cocks and faucets.*—To be mixed red and yellow brass, free of gas cocks and beer faucets.

10. *Heavy yellow brass.*—May consist of heavy brass castings, rolled brass, rod brass ends, chandelier brass, tubing, not to contain over 15 per cent of tinned and/or nickel-plated material; no piece to measure more than 12 inches over any one part and must be in pieces not too large for crucibles. Must be free of manganese mixture, condenser tubes, iron, dirt and excessive corroded tubing. Must be free of aluminum brass containing over 0.20 per cent aluminum.

11. *Yellow brass castings.*—Shall consist of brass castings in crucible shape, that is, no piece to measure more than 12 inches over any one part; must be free of manganese mixtures, tinned and nickel-plated material, and must be free of visible aluminum brass.

12. *Light brass.*—May consist of miscellaneous brass, tinned or nickel plated that is too light for heavy brass, to be free of gun shells containing paper, ashes or iron, loaded lamp bases, clock works, and automobile gaskets. Free of visible iron unless otherwise specified.

13. *Old rolled brass.*—May consist exclusively of old pieces of sheet brass and pipe free from solder, tinned and nickel-plated material, iron, paint, and corrosion, ship sheathing, rod brass, condenser tubes, and Muntz metal material.

14. *New brass clippings.*—Shall consist of the cuttings of new sheet brass to be absolutely clean and free from any foreign substances and not to contain more than 10 per cent of clean brass punchings to be not smaller than ¼ inch in diameter.

15. *Brass pipe.*—Shall consist of brass pipe, free of nickel-plated, tinned, soldered, or pipes with cast brass connections. To be sound, clean pipes free of sediment and condenser tubes.

16. *No. 1 red composition turnings.*—To be free of railroad car box turnings and similarly excessively leaded material, aluminum, manganese, and yellow brass turnings; not to contain over 2 per cent free iron; to be free of grindings and foreign material, especially babbitt. Turnings not according to this specification to be sold subject to sample.

17. *No. 1 yellow rod brass turnings.*—Shall consist of strictly rod turnings, free of aluminum, manganese, composition, Tobin and Muntz metal turnings; not to contain over 3 per cent free iron, oil, or other moisture; to be free of grindings and babbitts; to contain not more than 0.30 per cent tin and not more than 0.15 per cent combined iron.

18. *No. 1 yellow brass turnings.*—Shall consist of yellow brass turnings, free of aluminum, manganese, and composition turnings; not to contain over 3 per cent of free iron, oil, or other moisture; to be free of grindings and babbitts. To avoid dispute, to be sold subject to sample.

19. *Auto radiators (unsweated).*—All radiators to be subject to deduction of actual iron. The tonnage specification should cover the gross weight of the radiators, unless otherwise specified.

20. *No. 1 pewter.*—Shall consist of tableware and soda-fountain boxes, but in any case must test 84 per cent tin. Siphon tops to be treated for separately.

21. *Zinc.*—Must consist of clean sheet and cast zinc, also cast batteries to be free of loose oxide and dross, sal ammoniac cans, and other foreign materials.

22. *Zinc dross.*—Must be unsweated in slabs and must contain a minimum of 92 per cent of zinc.

23. *Tin foil.*—Shall consist of pure foil free of lead compositions and other foreign ingredients and matters.

24. *Electrotype shells.*—Must be hand picked and free of loose dross and chunks of dross.

25. *Scrap lead.*—Should be clean, soft scrap lead.

26. *Battery lead plates.*—Shall consist of dry battery lead plates, moisture not to exceed 1 per cent, allowance to be made for wood, rubber, and paper and excess moisture, or lead plus antimony content, dry basis, less a treatment charge.

27. *New sheet aluminum clippings and new aluminum wire.*—Shall consist of new sheet aluminum, cuttings, and new aluminum wire. Must be free from oil, grease, and any other foreign substances. Must be guaranteed not less than 98 per cent pure aluminum and not to contain more than 10 per cent of clean aluminum punchings to be not smaller than ¼ inch in diameter.

28. *Old aluminum wire.*—Shall consist of old aluminum wire guaranteed 98 to 99 per cent pure aluminum and must be free from iron cores, insulation, and any other foreign substance.

29. *Alloy sheet aluminum.*—To be sold on specification and sample.

30. *Painted sheet aluminum.*—Shall consist of painted sheet aluminum and must be absolutely free from iron, dirt, or any other foreign substance.

31. *Old sheet aluminum.*—Shall consist of old and manufactured sheet aluminum. Must be free from painted sheet aluminum, iron, dirt, and any other foreign substance.

32. *Aluminum castings.*—Shall consist of aluminum castings, free from iron, babbitt, brass, and any other foreign substance. Must not exceed 2 per cent of oil and grease. Free of pistons.

33. *Aluminum borings.*—To avoid dispute, should be sold subject to sample.

34. *Aluminum foil.*—Shall consist of pure aluminum foil, free from paper and any foreign ingredients.

35. *Babbitt metal.*—Shall contain bearing metal of all kinds. Shall not contain scrap hard metal, Allen metal (which is copper and lead alloys), die cast, ornamental metal, casket metal, zinc boxes, or type metal.

36. *Packages.*—Shall be good strong packages suitable for shipment, and each package shall be plainly marked with separate shipping marks and numbers and with the gross and tare weights, so that the packages may reach their destination and their weights can be easily checked.

There is a growing demand for scrap-metal specialties (not specifically covered by the preceding classification), such as nickel alloys, German silver, Monel metal, cadmium, and molybdenum. Difficulties in making shipments to buyers' specifications have arisen, and with the object of eliminating some of the trouble the Waste Trade Journal has published certain classifications used by one of its advertisers. It is worth while to reproduce those that follow so that they will be available to sellers of some metals and alloys.

Pure nickel clippings.—To consist of sheeting clippings, guaranteed 99 per cent nickel, to be free of solder material and other alloys. If in a state other than clippings, same is to be mentioned.

Pure nickel turnings.—To consist of nickel turnings free of iron or other foreign material.

No. 1 hard nickel anodes.—To consist of hard anodes with all hooks cut off close to the top of the anodes, to be free of soft, crumbly or heavily corroded anodes.

Nickel dust.—To consist of dry material from nickel anodes, to be free of yellow sulphate and dye-house sludge, or other foreign material.

Nickel platers' basket, hooks, racks, etc.—A good packing shall consist of baskets, hooks, racks, etc., made of either brass or copper, and to have a heavy nickel deposit. Baskets, hooks, racks, etc., made of iron, and which have a heavy nickel deposit to be packed separately. To avoid disputes, all plating baskets, hooks, racks, etc., should be sold subject to sample. Light deposited nickel baskets, hooks, racks, etc., shall not be considered good delivery.

Nickel strippings.—To consist of clean, sieved strippings or peelings, free of brass or copper, and other foreign material, and should not contain strippings that have copper layers in them.

New Monel metal clippings.—To consist of new clippings and skeleton scrap, to be free of brazed and soldered material or other metal attachments.

Monel metal rods, bars, shaftings.—Shall be cut in crucible shape, and to be free of casting or other metal attachments. When not in crucible shape, it should be so stated when asking for quotations.

Old Monel metal.—To consist of old Monel metal sheet scrap, free of solder and brazed material and other foreign attachments. If soldered, it should be so stated when asking for quotation.

Monel metal screen and wire.—To be free of soldered material and other foreign material. If soldered, it should be so stated when asking for quotation.

Monel metal turnings.—To consist of Monel metal from rods or turnings, to be free of nickel alloy turnings, other metals and foreign material, and to be sold subject to sample. Turnings from Monel castings to be packed and sold separately.

Monel metal castings.—To consist of castings made from Monel metal only, and in crucible shape, to be free of other nickel alloy composition material, and when not in crucible shape to be so stated when asking for quotations.

Monel metal punchings.—To consist of clean punchings, free of iron or other foreign material.

German silver (nickel silver), sheet clippings, or skeleton scrap.—To consist of clean sheet cuttings or skeleton material, free of other metals or metal attachments and soldered stock. If lots are of a uniform nickel content, the nickel contents should be so stated and guaranteed, otherwise to be sold subject to sample.

German silver turnings.—Shall consist of clean turnings or chips, free of other metals and foreign material, to be sold subject to sample.

Silver-plated ware.—To consist of spoons, forks, and tableware, free of mesh bags, novelty material and compact cases, also free of nickel-plated material and silver flashed stock.

Mercury (quicksilver).—To consist of clean mercury, free of amalgam, zinc dross and tin dross and other foreign material.

Mirror scrappings.—To be sold subject to sample.

Cadmium anodes.—To consist of clean anodes, free of dross, strippings, or other foreign material.

Cadmium strippings.—To be clean stock, free of brass or other foreign material.

Cadmium dross.—To be sold subject to sample.

Bell metal.—Shall consist of large and small bells of a tin-copper composition. It shall be free of yellow brass bells, manganese bells, or other alloy compositions. Cymbals shall be packed separately, and shall not be included in a No. 1 packing of bells.

High-speed tool-steel scrap.—Shall consist of American-made high-speed tool steel with a minimum 15 per cent tungsten contents and shall be free of semi-high-speed tools, high-speed tools with carbon shanks, carbon tools steel or other steel alloyed material.

Molybdenum scrap.—Shall consist of clean, pure molybdenum material in sheet, cast wire or bar stock, and shall be free of nickel or other metal alloys, to be sold subject to sample.

Aluminum foil.—To consist of clean aluminum foil, free of paper, print, pot stack, and other foreign material.

Rifle shells.—Shall consist of clean fired shell, shall be hand-picked and free of any shells containing powder, iron, muffled shells or burnt shells or any material that is foreign. State caliber when asking for quotations.

Cupro-nickel jackets.—To be free of iron, aluminum, or other foreign material, to be sold subject to sample.

NOTE.—When offering alloy material of special character, furnish complete analysis—state what shape it is in, the quantity available, and send a representative sample.

REVIEW OF THE SECONDARY METAL INDUSTRY IN 1930

MARKET CONDITIONS

The total decrease in quantity of the secondary metals covered in this inquiry was 24 per cent in 1930, compared with an increase of 7 per cent in 1929. There were large decreases in the quantity of copper, copper alloys, lead, zinc, tin, antimony, aluminum, and nickel. This general decrease in quantity and the much lower average prices of all metals except nickel and aluminum, especially the lower prices of copper and tin, resulted in a decrease in 1930 of $137,773,800 in total value. The price of primary nickel was stable, and that of primary aluminum declined less than the prices of the other metals.

Domestic industries decreased their consumption of metallic materials below normal and very much below the consumption during the period of expansion in 1929. Apparently, the use of secondary copper, bronze, and brass decreased about 25 per cent. The steadily declining prices of most metals did not encourage the purchasing or the holding of scrap metals, so that dealers and brokers bought and conditioned less waste material and generally shipped it promptly. Foundries bought only metals (secondary or primary) that were actually needed to fill orders for their products. Some of the larger secondary smelters have accumulated good stocks of scrap and have adequate, although not excessive, supplies of secondary pig metals. Any normal increase in the rate of domestic consumption should enable such stocks to be sold at a profit. Sales of secondary ingot brass were much smaller in 1930 than in 1929; this decrease was due solely to a smaller demand for products and not to any failure of ingot makers to market satisfactory material. The quality of such ingots tends to improve steadily, and with the increasing number of alloys used and the greater difficulty of separating them more of such alloys will go to large secondary plants that can refine and reuse them under adequate refining methods to produce high-grade ingots of desired specifications.[5]

PRICES OF SOME SCRAP METALS AND ALLOYS

The tables that follow show certain scrap-metal prices at New York in 1930, as quoted by the Waste Trade Journal and the American Metal Market.

The dealers' weekly average buying price in New York of No. 1 heavy scrap copper ranged from 13.62½ to 13.75 cents a pound during January, February, March, and early April. The price declined the third week in April to 10.37½ cents and in May to 9.12½ cents. In July the price opened at 9.50 cents but declined to 8.37½ cents; the latter price was stable until the third week in September. The last week in September the price decreased to 8.12½ cents, and prices in October ranged from 8.12½ to 7.62½ cents. The price in November and December was steady at 7.62½ cents. The highest price quoted in 1930 was 13.75 cents and the lowest was 7.62½ cents. The spread was 6.12½ cents a pound in 1930, compared with a spread of 6.25 cents in 1929.

No. 1 composition scrap (red brass) showed a range of 4.25 cents a pound in 1930, compared with a range of 5.12 cents in 1929. In 1930 it was highest at 11.12½ cents during the first quarter and lowest at 6.87½ cents during the last quarter.

The price of heavy scrap lead began 1930 at 4.75 cents a pound; at the end of March it was 4.50 cents; at the end of April it was 4.37½ cents; and in May, June, and July it was 4 cents. In August the price advanced to 4.30 cents and remained stable until the second week in October, when it slumped again to 4 cents. The price was stable at 4 cents during November and December. The quotations for heavy lead ranged from 4 to 4.75 cents a pound.

The range in the price of scrap zinc in 1930 was 1.25 cents a pound, compared with 0.87 cent in 1929. In 1930 the price was as high as 2.87½ cents in January and as low as 1.62½ cents in December. The price was very steady at 2 cents from July to the end of November.

There was a larger range in the quoted prices of cast aluminum in 1930 than in 1929. In 1930 the range was from 5.12½ to 10.25 cents and in 1929 from 9.50 to 12.50 cents a pound. The highest price in 1930 was in January and the lowest in December. Monthly prices of new aluminum clippings ranged from a high of 15.62 cents for January and February to a low of 12.28 cents for December; the monthly prices tended steadily downward in 1930.

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[5] Jacobson, W. H., and Kelley, William, The Scientific Production of Nonferrous Ingots: Metal Ind., April, 1931, pp. 149-151.

The price of secondary tin, which had a range of 12.36 cents a pound in 1930, usually follows closely the trend of prices for primary 99 per cent tin. Block-tin pipe was quoted as high as 33 cents for January. A decline started in February and continued until October, when the price stiffened. The small advance continued during November but was followed by a slight decline in December. The lowest average monthly price was 20.64 cents for October.

Although the sales of primary nickel were smaller in 1930 than in 1929 and recoveries of scrap nickel and nickel alloys decreased, the price of primary nickel was stable and the prices of scrap nickel and scrap Monel metal held fairly steady.

Of the nonferrous metals tin and copper showed the widest range of prices in both 1930 and 1929; however, the relative decrease during 1930 was greater in the price of aluminum than in that of copper and greater in the price of zinc than in that of tin. Quotations on old battery plates were lowest in November and December. Fewer plates were remelted, although they were purchased at prices ranging from 40 to 50 per cent of the prevailing price of pig lead.

Average scrap-metal prices in 1930, in cents per pound [1]

[New York dealers' weekly average buying prices f.o.b. New York]

Date	No. 1 copper and wire, miscellaneous	No. 1 composition	Heavy lead	Old zinc	Cast aluminum, mixed	Date	No. 1 copper and wire, miscellaneous	No. 1 composition	Heavy lead	Old zinc	Cast aluminum, mixed
Jan. 4	13.75	11.12½	4.75	2.87½	10.25	July 5	9.50	8.12½	4.00	2.12½	7.50
11	13.62½	11.12½	4.75	2.62½	9.25	12	8.62½	7.75	4.00	2.00	7.25
18	13.62½	11.12½	4.75	2.62½	9.25	19	8.37½	7.50	4.00	2.00	7.25
25	13.75	11.12½	4.75	2.62½	9.25	26	8.37½	7.50	4.00	2.00	7.25
Feb. 1	13.75	11.12½	4.75	2.62½	9.75	Aug. 2	8.37½	7.50	4.00	2.00	7.25
8	13.75	11.12½	4.75	2.62½	9.75	9	8.37½	7.50	4.00	2.00	7.25
15	13.75	11.12½	4.75	2.62½	9.25	16	8.37½	7.50	4.00	2.00	7.25
22	13.75	11.12½	4.75	2.62½	9.25	23	8.37½	7.62½	4.30	2.00	7.25
Mar. 1	13.75	11.12½	4.75	2.62½	9.25	30	8.37½	7.62½	4.30	2.00	7.25
8	13.75	11.12½	4.62½	2.62½	9.25	Sept. 6	8.37½	7.62½	4.30	2.00	7.25
15	13.75	11.12½	4.50	2.62½	9.25	13	8.37½	7.62½	4.30	2.00	7.25
22	13.75	11.12½	4.50	2.62½	9.25	20	8.37½	7.62½	4.30	2.00	7.25
29	13.75	11.12½	4.50	2.62½	9.25	27	8.12½	7.12½	4.30	2.00	7.25
Apr. 5	13.75	11.12½	4.50	2.62½	8.87½	Oct. 4	8.12½	7.12½	4.30	2.00	7.25
12	13.75	11.12½	4.12½	2.62½	8.25	11	7.62½	6.87½	4.00	2.00	7.25
19	10.37½	8.12½	4.37½	2.37½	8.12½	18	7.62½	6.87½	4.00	2.00	7.25
26	10.37½	8.12½	4.37½	2.37½	8.12½	25	7.62½	6.87½	4.00	2.00	7.25
May 3	10.37½	8.12½	4.37½	2.37½	8.12½	Nov. 1	7.62½	6.87½	4.00	2.00	7.25
10	9.12½	7.12½	4.05	2.12½	7.75	8	7.62½	6.87½	4.00	2.00	7.25
17	9.12½	7.12½	4.00	2.12½	7.75	15	7.62½	6.87½	4.00	2.00	7.25
24	9.12½	7.12½	4.00	2.12½	7.75	22	7.62½	6.87½	4.00	2.00	7.25
31	9.12½	7.12½	4.00	2.12½	7.75	29	7.62½	6.87½	4.00	2.00	7.25
June 7	9.12½	7.12½	4.00	2.12½	7.50	Dec. 6	7.62½	7.00	4.00	1.62½	6.12½
14	9.75	8.37½	4.00	2.12½	7.50	13	7.62½	6.87½	4.00	1.62½	5.12½
21	9.50	8.12½	4.00	2.12½	7.50	20	7.62½	6.87½	4.00	1.62½	5.12½
28	9.50	8.12½	4.00	2.12½	7.50	27	7.62½	6.87½	4.00	1.62½	5.12½

[1] Waste Trade Journal, New York, Jan. 24, 1931.

The following monthly average prices at New York in 1930 for new scrap-zinc clippings, old zinc, block-tin pipe, and new aluminum clippings, in cents per pound, were quoted by the American Metal Market.

Average scrap-metal prices at New York in 1930, in cents per pound [1]

Month	New scrap-zinc clippings	Block-tin pipe	New aluminum clippings	Month	New scrap-zinc clippings	Block-tin pipe	New aluminum clippings
January	3.25	33.00	15.62	August	2.87	23.50	13.25
February	3.32	31.82	15.62	September	2.87	23.40	13.25
March	2.54	30.64	15.08	October	2.74	20.64	12.99
April	3.05	30.12	14.49	November	2.62	20.96	12.87
May	3.00	25.07	14.08	December	2.53	20.81	12.28
June	2.83	23.88	13.75				
July	2.65	23.50	13.25	Year	2.86	25.61	13.87

[1] Metal Statistics, 1931.

SECONDARY METALS RECOVERED

The quantity of metals contained in numerous alloys made partly or wholly from secondary material can not be ascertained definitely. The figures given as the result of the annual canvass are only approximate, but they constitute the sole available data on an important industry.

The decrease in the value of the secondary metals, exclusive of gold, silver, platinum, iron, steel, and ferro-alloys, recovered in the United States in 1930 was due mainly to the lower average price of copper and the smaller quantity of copper and copper alloys treated. There were, however, large decreases in the quantity of all and in the price of most of the other metals covered in this report.

The quantity of secondary platinum metals recovered in the United States in 1930 was 47,316 troy ounces, 4,557 ounces more than in 1929, and was equivalent to 34 per cent of the platinum metals imported for consumption in 1930.

The value of the gold and silver contained in old jewelry, dental waste, tableware, ornaments, and other articles remelted or refined in 1930 was $24,681,961. Mints and refineries reported the recovery of 6,472,713 fine ounces of silver and $22,189,966 in gold from waste or discarded material. Jewelry and dental waste furnish the largest quantity of secondary gold, and silverware and photographic waste furnish the largest quantity of secondary silver.[6] The consumption of silver in the arts and industries in the United States in 1930 is estimated at 36,343,207 ounces, a decrease from 1929 of 6,015,875 ounces. Most of the silver recovered from photographic wastes is obtained from solutions and is recovered by makers of films and plates and by the motion-picture industry.[7] The quantity of silver recovered from old films in 1930 was less than in 1929 as a result of the lower price of silver.

In 1930 no recovery of secondary mercury was reported from old dumps and slimes at mills which formerly treated gold and silver ores by amalgamation. About 13,000 pounds were reported from this source in Nevada in 1929.

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[6] Hoke, C. M., Methods of Handling Gold and Platinum Wastes: Metal Ind., June, 1927, pp. 240-242, and September, 1927, pp. 371-372.

[7] Weisburg, Louis, Recovery of Silver from Solutions Used in Photographic Work: U. S. Patent 1527942, Feb. 24, 1925.

No data are collected by the Bureau of Mines showing the quantity of secondary ferrous metals and alloys collected and sold for remelting or the quantity and value of old rails, pipe, machinery, and other equipment renovated for original use. A cursory glance at newspapers and trade publications shows that an enormous quantity of such ferrous material is salvaged and reused. Its value probably exceeds that of the ferrous material sent to furnaces and foundries.

It is stated that a total of about 13,500,000 tons of old scrap iron and steel was transported by railways in 1929. This total represents outside collections and does not include scrap made inside mills and furnaces or part of the large quantity of scrap from railways.

Secondary metals of certain classes recovered in the United States, 1929 and 1930

	1929		1930	
	Short tons	Value	Short tons	Value
Copper, including that in alloys other than brass	417,600	$146,995,200	332,800	$86,528,000
Brass scrap remelted	298,500	76,000,000	192,000	39,000,000
Lead as metal	138,500	39,186,000	129,000	25,580,000
Lead in alloys	172,500		126,800	
Zinc as metal	65,400	10,164,000	49,300	5,472,000
Zinc in alloys other than brass	11,600		7,700	
Tin as metal	7,400	30,513,300	5,600	16,228,300
Tin in alloys and chemical compounds	26,900		20,600	
Antimony as metal	52	1,990,200	8,082	1,239,800
Antimony in alloys	11,079			
Aluminum as metal	25,850	23,135,200	19,700	17,177,000
Aluminum in alloys	22,550		18,900	
Nickel as metal	850	3,045,000	500	2,030,000
Nickel in nonferrous alloys and salts	3,500		2,400	
	1,202,281	331,028,900	913,382	193,255,100

Secondary metals of certain classes recovered in the United States, 1921–1930, in short tons

	1921	1922	1923	1924	1925
Copper, including that in alloys other than brass	113,350	144,100	193,200	196,500	250,600
Brass scrap remelted	148,500	274,000	311,000	274,000	242,300
Lead as metal	46,370	75,480	96,430	90,400	112,420
Lead in alloys	57,410	84,080	98,060	114,100	114,460
Zinc as metal	33,833	69,314	65,210	58,886	61,430
Zinc in alloys other than brass	5,840	10,250	8,630	10,500	13,300
Tin as metal	5,400	6,570	7,892	7,700	7,950
Tin in alloys and chemical compounds	11,500	12,940	22,318	23,600	23,000
Antimony as metal	29	182	245	90	1
Antimony in alloys	4,691	6,908	7,776	9,314	10,839
Aluminum as metal	3,650	7,190	6,800	10,350	17,700
Aluminum in alloys	5,250	9,100	14,500	16,650	26,300
Nickel as metal	86	104	177	114	191
Nickel in nonferrous alloys and salts	859	1,408	1,373	2,126	2,109
Total quantity	436,768	701,626	833,611	814,330	882,600
Total value	$89,140,500	$143,891,700	$205,418,600	$200,578,600	$243,570,700

Secondary metals of certain classes recovered in the United States, 1921–1930, in short tons—Continued

	1926	1927	1928	1929	1930
Copper, including that in alloys other than brass	281,700	290,000	325,000	417,600	332,800
Brass scrap remelted	283,000	286,000	302,000	298,500	192,000
Lead as metal	125,000	119,000	138,000	138,500	129,000
Lead in alloys	152,300	157,000	170,600	172,500	126,800
Zinc as metal	64,570	64,800	70,700	65,400	49,300
Zinc in alloys other than brass	13,430	12,400	12,500	11,600	7,700
Tin as metal	9,750	8,800	8,200	7,400	5,600
Tin in alloys and chemical compounds	23,650	28,100	27,600	26,900	20,600
Antimony as metal	2,910	1,700	745	52	8,082
Antimony in alloys	13,320	10,700	11,155	11,079	
Aluminum as metal	20,500	23,000	24,500	25,850	19,700
Aluminum in alloys	23,700	23,200	23,300	22,550	18,900
Nickel as metal	485	480	635	850	500
Nickel in nonferrous alloys and salts	2,565	2,900	3,865	3,500	2,400
Total quantity	1,016,880	1,028,080	1,118,800	1,202,281	913,382
Total value	$274,540,900	$256,352,000	$274,611,300	$331,028,900	$193,255,100

SECONDARY COPPER

Secondary copper recovered in the United States, 1929 and 1930, and imports and exports of brass and copper scrap, in short tons

	1929	1930
Copper as metal	297,600	244,800
Copper in alloys other than brass	120,000	88,000
	417,600	332,800
Copper from new scrap (not including brass)	113,000	62,700
Copper from old scrap (not including brass)	304,600	270,100
	417,600	332,800
Brass scrap remelted:		
New clean scrap	156,000	89,000
Old scrap	142,500	103,000
	298,500	192,000
Copper content of brass scrap (averaging 70 per cent copper):		
New scrap	109,200	62,300
Old scrap	99,750	72,100
	208,950	134,400
Total secondary copper (including copper content of brass scrap):		
From new scrap	222,200	125,000
From old scrap	404,350	342,200
	626,550	467,200
As metal	297,600	244,800
In brass and other alloys	328,950	222,400
	626,550	467,200
Brass scrap imported	7,031	3,573
Scrap copper imported	6,797	3,750
Brass scrap exported	26,867	22,613
Scrap copper exported	18,818	16,943

The plants refining mainly primary metal recovered 140,270 short tons of the total secondary copper recovered in 1930, or about 26,800 tons less than they reported in 1929. The copper produced by smelters of secondary material included 104,530 tons of pig copper, 88,000 tons of copper in alloys other than brass, and 134,400 tons of copper in remelted brass. These figures indicate decreases of 25,990 tons of pig copper, 32,000 tons in alloys other than brass, and 74,550 tons in remelted brass. The total value of the secondary copper as metal and in alloys computed at 13 cents a pound—the average price for 1930 of all merchantable grades of new metal—was $121,472,000.

The imports of scrap copper decreased from 6,797 tons in 1929 to 3,750 tons in 1930, and the imports of scrap brass decreased from 7,031 tons in 1929 to 3,573 tons in 1930.

The combined exports of scrap copper and scrap brass in 1930 decreased 13 per cent from those in 1929. The exports of scrap copper in 1930 amounted to 16,943 tons and those of scrap brass to 22,613 tons.

The figures relating to copper show that the relative decrease in recoveries from scrap by the regular smelters was not so large as that by the secondary smelters.

Railways are among the largest producers of scrap metals, most of which are sold to dealers and smelters. Railroads are not, however, large purchasers of secondary metals. Reports for 1930 show that the railways reused at their shops or plants considerably smaller quantities of secondary metals, such as babbitt, solder, and bronze, than they did in 1929. The following quantities of scrap metals were utilized by railroads in 1930: 4,100 tons of brass; 600 tons of copper; 11,200 tons of copper in alloys other than brass; 1,700 tons of tin in babbitt, solder, and bronze; and 4,500 tons of lead in various alloys.

The Non-Ferrous Metal Ingot Institute has adopted specifications covering the manufacture of nonferrous ingots. These specifications were drawn by committees of the American Society for Testing Materials and they institute and cover 15 of the dominant compositions. The list of these 15 alloy specifications is given in Metal Industry for April, 1931 (p. 150). An article [8] by E. Perry contains a table of standard and special bronze mixtures.

J. W. Furness, minerals division, Bureau of Foreign and Domestic Commerce, is making a survey as to where secondary copper originates; to whom it goes; by whom it is used; and the quantities of the various grades of scrap copper, skimmings, drosses, and alloys containing copper produced in 1930.

An electrolytic refinery for the treatment of scrap copper and brass was operated at St. Louis, Mo., in 1930.

SECONDARY LEAD

Secondary lead recovered in the United States, 1929 and 1930, in short tons

	1929	1930
Secondary lead recovered by smelters that treat mainly ore	65,359	48,135
Secondary lead recovered by smelters that treat only scrap and drosses	73,141	80,865
	138,500	129,000
Secondary lead recovered in remelted alloys:		
Lead content of antimonial lead scrap treated at regular lead smelters	15,692	9,804
Lead content of drosses and scrap alloys treated at secondary smelters	156,808	116,996
	172,500	126,800
Total secondary lead recovered	311,000	255,800

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[8] Perry, E., White Metals, Brasses, and Bronzes: Metal Ind., August, 1930, pp. 376–377.

Refined primary lead produced in the United States, 1929 and 1930, in short tons

	1929	1930
From domestic ore	672, 498	573, 740
From foreign ore and base bullion	102, 135	69, 293
Lead content of antimonial lead from foreign and domestic ores and bullion treated at regular smelters	22, 617	12, 026

The output of secondary lead in 1930 was equivalent to 40 per cent of the total output of refined primary lead in the United States and was more than 56,000 tons greater than the output of primary lead from ores mined in Missouri, the largest lead-producing State.

The quantity of secondary lead recovered was 55,200 tons less in 1930 than in 1929; that recovered as pig lead was 9,500 tons less. The quantity of secondary lead recovered by those smelters whose product is mainly primary metal decreased more than 17,200 tons, whereas the quantity of pig lead recovered at secondary smelters increased. The quantity of lead recovered in alloys decreased 45,700 tons. The regular smelters of primary metal reported a decrease of about 5,900 tons in the lead content of antimonial lead scrap treated by them, so that secondary smelters in 1930 recovered about 32,100 tons less pig lead and lead in alloys than they did in 1929.

The main sources of supply of secondary lead are battery plates, lead cable, lead pipe, lead lining of acid tanks, babbitt, solder, type metal, terne metal, and white metal drosses. As trade conditions were poor, fewer batteries were discarded and less old babbitt and solder were marketed. There were considerable stocks of old battery plates in the hands of dealers and smelters, and purchasers were inclined to pay a smaller percentage of the price of pig lead for them. Active competition for battery plates in some years had resulted in excessive prices being paid for such material. The average moisture in winter shipments of old batteries is said to be about 6.5 per cent and in summer shipments about 4.5 per cent. Insufficient drying or seasoning or excessive quantities of battery mud frequently result in shipments containing much more moisture; this entails excessive freight charges and a greater refining cost.

SECONDARY ZINC

Secondary zinc[1] recovered in the United States, 1929 and 1930, and products made from zinc dross, skimmings, and ashes, in short tons

	1929	1930
Secondary zinc recovered by redistillation	47, 348	[2] 34, 849
Secondary zinc recovered by sweating, remelting, etc	18, 052	14, 451
Total zinc recovered unalloyed	65, 400	49, 300
Zinc recovered in alloys other than brass	11, 600	7, 700
Zinc recovered in brass (estimated)	65, 670	42, 300
Zinc dust made from zinc dross	7, 424	6, 394
Zinc dross used for zinc dust (estimated)	8, 620	7, 450
Zinc concentrates and ore exported	71	----------
Zinc dross exported	3, 490	1, 162
Lithopone made from zinc skimmings and ashes	65, 364	74, 034
Secondary zinc content of lithopone	12, 871	14, 679
Zinc chloride made from zinc skimmings, ashes, etc	[3] 44, 873	29, 697
Zinc content of zinc chloride made from zinc skimmings, etc	[3] 9, 871	6, 532
Zinc content of zinc sulphate made from zinc skimmings, ashes, etc	894	784

[1] Figures do not include scrap and dross used for lithopone, oxide, zinc dust, or chloride. The use for some of these, especially for zinc chloride, is quite large.

[2] Includes 22 tons of secondary electrolytic zinc

[3] Revised figures.

Secondary zinc recovered as pig metal and in alloys (including brass) decreased 43,370 tons in 1930. This decrease was partly in redistilled zinc from drosses but was caused mainly by large decreases in various alloys.

The quantity of secondary zinc in brass (42,300 tons) and in alloys other than brass (7,700 tons) decreased 27,270 tons. The total recovery of secondary zinc (including that in brass) in 1930 was equivalent to 20 per cent of the total output of primary zinc in the United States.

The quantity of zinc recovered by redistillation decreased from 47,348 tons in 1929 to 34,849 tons in 1930. Of the 1930 total 15,102 tons, a decrease of 4,363 tons, were recovered at retort smelters that treat mainly ore, and 19,747 tons, a decrease of 8,136 tons, were recovered by redistillation of zinc drosses at six plants that use large graphite retorts of 600 to 800 pounds capacity instead of small clay retorts, such as are used by smelters treating zinc concentrates or mixed concentrates and drosses.

The six zinc smelters that used the large retorts in 1930 were as follows:

Birmingham Smelting & Refining Co., Birmingham, Ala.
Federated Metals Corporation, Trenton, N. J.
General Smelting Co., Philadelphia, Pa.
Superior Zinc Corporation, Philadelphia, Pa.
Tottenville Copper Co., Tottenville, N. Y.
Wheeling Steel Corporation, Wheeling, W. Va.

Of the secondary zinc recovered unalloyed, 71 per cent was obtained by redistillation and the remainder by sweating and remelting. The latter processes do not yield all the metal content, so that the residues are sold to secondary smelters for redistillation or are sold to makers of chemical compounds. Most of the zinc chloride is made from zinc skimmings and other residues; much of the zinc sulphate, zinc dust, and lithopone is also made from such materials, so that there is normally an active market for zinc drosses, skimmings, and ashes. A description of modern practice in producing good zinc from scrap and other wastes, prepared by E. R. Thews, is given in Metal Industry, February, 1927 (pp. 600–602), and March, 1927 (pp. 107–108).

The quantity of zinc dross used to make zinc dust decreased about 1,200 tons, or 14 per cent, in 1930. It is estimated that 7,450 tons of dross were used to make 6,394 tons of zinc dust.

Of the total output of 175,333 tons of lithopone (a zinc pigment containing approximately 20 per cent of zinc) 74,034 tons, containing 14,679 tons of zinc, were made from zinc skimmings and ashes (8,670 tons more than the quantity of lithopone made from zinc residues in 1929).

The quantity of zinc chloride made in 1930 was 29,719 tons (a decrease of 15,178 tons), of which 29,697 tons, containing 6,532 tons of zinc, were made from zinc residues. Zinc sulphate containing 784 tons of zinc was made from zinc skimmings and galvanized clippings. Only a small quantity was made from galvanized steel in 1930. There was probably no extension in the use of zinc oxide to weight certain cotton products.

The exports of zinc dross decreased from 3,490 tons in 1929 to 1,162 tons in 1930. The export demand at the end of 1930 was negligible.

The American Bureau of Metal Statistics estimates that 217,000 short tons of zinc—73,000 tons less than in 1929—were used in 1930 for zincking (galvanizing) sheets, forms, tubes, wire, etc.

Some zinc chloride may have been made from zincked scrap, but as zinc was too cheap to render such an operation profitable zinc coatings on metals yielded little or no secondary recovery.

There is an increasing tendency to prevent the large loss of zinc in smelting scrap brass, but the prevailing low price of zinc in 1930 did not encourage the recovery of the zinc as oxide.

SECONDARY TIN

Secondary tin recovered in the United States, 1929 and 1930

	1929	1930
Tin recovered as pig tin short tons..	7,400	5,600
Tin recovered in alloys and chemical compounds do....	26,900	20,600
	34,300	26,200
Clean tin-plate scrap treated at detinning plants long tons..	221,643	208,282
Metallic tin recovered at detinning plants pounds..	1,709,264	2,311,035
Tin content of tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants pounds..	5,381,243	5,173,701
Total tin recovered at detinning plants do....	7,090,507	7,484,736
Tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants pounds..	11,028,529	10,656,966
Average quantity of tin recovered per long ton of clean tin-plate scrap do....	31.9	35.9

Tin (metal) and tin concentrates (tin content) imported into the United States, 1929 and 1930, in short tons

	1929	1930
Tin imported as metal	97,583	90,422
Tin concentrates (tin content) imported	143	324

The United States in 1930 consumed tin in amount equivalent to about 50 per cent of the world's output of primary tin in 1930; the domestic production, mainly from Alaska, was about 24 tons of tin concentrates containing 17 short tons of tin.

The secondary tin recovered in the United States in 1930 was equivalent to 29 per cent of the tin imported into the United States as pig metal in 1930 (90,422 short tons).

The recovery of secondary tin in 1930 amounted to 26,200 short tons, valued at $16,228,300, compared with 34,300 tons, valued at $30,513,300 in 1929. The total value assigned is based on the yearly average price (30.97 cents a pound in 1930) given by the American Metal Market for 99 per cent metal, prompt delivery at New York, a price that was 13.51 cents a pound less than the average price in 1929.

The quantity of secondary pig tin recovered decreased 1,800 tons. The largest recoveries of tin as tin are made from scruff and drosses that occur in making tin plate. Considerable block-tin pipe was formerly marketed as scrap, but this source is no longer a factor of any importance. The recoveries of tin from scruff and drosses decreased from 6,100 short tons in 1929 to 4,900 tons in 1930. The quantity of tin plate and terneplate made in 1930 (according to the

American Iron and Steel Institute) was 1,763,443 long tons, or 204,837 tons less than in 1929. The quantity of tin estimated to have been used for such products is 26,798 long tons. The decrease in the quantity of tin recovered in alloys and chemical compounds was due mainly to the large decrease of tin in tin alloys.

Nearly all detinning in the United States is done by the electrolytic process or by the chlorine process. Many of the earlier chapters of this series contain data relating to the plants and processes followed, and a complete history of the different methods of detinning is given in an article entitled "Scrap Detinning Affords Big Outlet for Chlorine," by C. L. Mantell, in Chemical and Metallurgical Engineering, August, 1926 (pp. 477–479).

Tin-plate clippings imported in 1930 amounted to 10,411 short tons, which came from Canada.

Reports received show that the quantity of clean tin-plate scrap detinned in 1930 was 13,361 long tons less than in 1929 and that a smaller quantity of tin compounds and more metallic tin were made than in 1929. The average tin content of the tin oxide made by detinners was given as 78 per cent, that of tin bichloride as 24.5 per cent, and that of tin tetrachloride as 45.4 per cent. The average cost of tin-plate clippings delivered at the plants in 1930 was $9.59 a long ton, and the average recovery of tin per long ton of clean tin-plate scrap was 35.9 pounds.

The quantity of tin on tin-plate clippings has not increased, but greater efficiency at the large detinning plants has increased the ratio of recovery of tin from such scrap.

New tin-plate clippings were treated at plants of the Vulcan Detinning Co. at Sewaren, N. J., Neville Island, Pa., and Streator, Ill.; by the Johnson & Jennings Co., of Cleveland, Ohio; and at the plants of the Metal & Thermit Co. at South San Francisco, Calif., East Chicago, Ind., and Chrome, N. J.

The tin reported recovered in alloys and compounds in 1930 included the tin content of products made from clean tin-plate scrap. Most of the tin recovered at the plants listed was in tin bichloride, tin tetrachloride, and tin oxide. As the products are made from scrap tin and thus conserve the primary metal they are properly regarded as recovered tin.

It is estimated that about 30,000 short tons of tin were used in the United States in 1930 by the makers of tin plate and terneplate and that the total recovery of secondary tin as metal and in compounds from tin-plate scrap in 1930 was 3,742 short tons. Most of this tin was recovered in tin compounds and not as metal, because in recent years there has been a greatly increased consumption of tin compounds in the silk industry. This use, however, did not increase in 1930.

As described in former reports of this series on secondary metals, several plants are equipped to handle old tin-coated containers, but the low price of tin and the cost of collecting such material has precluded its use as a source of tin, so that no old tin containers have been treated for the tin coating since 1928. Some old cans were remelted in Philadelphia in 1930 to make window weights, and old cans were collected locally in Los Angeles to make tin scrap for use in precipitating copper from mine waters. The detinned loose scrap from the detinning plants in San Francisco is also available to supply the market for this use, which with the return of normal output from copper mines probably will expand considerably.

Technical Paper 236 of the American Institute of Mining Engineers, by P. J. Potter, gives data relating to the recovery of wastes from tin base babbitting operations. A book written by C. L. Mantell of Pratt Institute, Brooklyn, N. Y., entitled "Tin, Its Mining, Production, Technology, and Application," includes chapters on the sources of secondary tin and on the various methods of detinning tin-plate scrap.

SECONDARY ANTIMONY

Secondary antimony recovered in, primary antimonial lead produced in, and antimony imported into and exported from the United States, 1929 and 1930, in short tons

	1929	1930
Secondary antimony in antimonial lead scrap smelted at regular smelters	1,883	1,282
Secondary antimony recovered at secondary smelters	9,248	6,800
	11,131	8,082
Primary antimonial lead produced at regular smelters	25,669	13,711
Antimony content of primary antimonial lead	3,052	1,685
Antimony imported in ore, as metal, or as oxide or salts	16,963	10,059
Foreign antimony exported	509	493

The production of secondary antimony in the United States in 1930, practically all of which was recovered in alloys, aggregated 8,082 tons, a decrease of 27 per cent from the recovery reported in 1929. The average price of ordinary brands of antimony in 1930, as published by the American Metal Market, was 7.67 cents a pound, compared with 8.94 cents in 1929. Those smelters that ordinarily use primary ores, concentrates, or metals reported the recovery of 1,282 tons of antimony contained in 11,086 tons of antimonial lead scrap, or 601 tons less than they reported in 1929. The recovery of secondary antimony by the secondary smelters showed the large decrease of 2,448 tons in 1930.

The imports of antimony in 1930 decreased about 6,900 tons, and the quantity of primary antimonial lead made at regular smelters decreased more than 11,900 tons.

Fewer motor cars were scrapped in 1930, and there was a big decrease in batteries needed for new cars. Moreover, fewer large batteries are now being used, and the lead plates and lead oxide used weigh less than formerly. The average monthly output of old batteries probably did not exceed 12,000 to 13,000 tons in 1930.

The principal materials refined or remelted that contained antimony as an alloy were hard-lead drosses, babbitt, bearing metal, battery plates, pewter, and type metal. The antimony used in the pigment, paint, and ceramic industries is so dissipated that no secondary recoveries can be made, but a large proportion of the production of metal containing antimony returns in a few months or a few years for refining and reuse. Dealers and brokers return much of the battery plates, and users of bearing metal and type metal regularly ship their used material to the makers of type metal and bearing metal and are credited with its value against the shipments of refined alloys.

Most of the old battery plates are collected by dealers and shipped to secondary smelters that buy them at a price based on the price of pig lead at St. Louis. The antimony content is paid for at the price of lead; this price in 1930 was 5 cents, or 2.67 cents less than the average price of ordinary brands of antimony. As antimony is used mainly in an alloy it is seldom separated in refining scrap.

The ratio of recovery of secondary antimony or antimonial lead to imports of antimony is expanding, and it is likely that in 1931 and succeeding years a considerable quantity of antimony from battery plates will be recovered and marketed as antimony and not recovered as antimonial lead.

SECONDARY ALUMINUM

Secondary aluminum recovered in the United States, 1929 and 1930, in short tons

	1929	1930
Secondary aluminum recovered unalloyed	25,850	19,700
Aluminum recovered in alloys (mainly No. 12)	22,550	18,900
	48,400	38,600

Primary aluminum produced in the United States and imported and exported, 1929 and 1930, in pounds

	1929	1930
Primary aluminum produced in the United States	225,000,000	229,035,000
Aluminum (crude and semicrude) imported for consumption	50,880,823	25,461,179
Aluminum (crude and semicrude) exported	17,032,117	17,329,511

The value of primary aluminum produced in the United States in 1930 was $50,961,000, compared with $51,864,000 in 1929.

The recovery of secondary aluminum as pig aluminum or in alloys in 1930 amounted to 38,600 tons, valued at $17,177,000, compared with 48,400 tons, valued at $23,135,200, in 1929.

Some of the larger secondary smelters, refiners, and users of aluminum in 1930 were as follows:

Aluminum Industries (Inc.), Cincinnati, Ohio.
Aluminum Smelting & Refining Co., Cleveland, Ohio.
Apex Smelting Co., Chicago, Ill.
Aurora Refining Co., Aurora, Ill.
Bohn Aluminum & Brass Corporation, Detroit, Mich.
Cleveland Electro Metals Co., Cleveland, Ohio.
Fairmont Aluminum Co., Fairmont, W. Va.
Federated Metals Corporation, New York, N. Y.
General Metals Refining Co., St. Louis, Mo.
Hamden Smelting Co., Hamden, Conn.
Wm. F. Jobbins (Inc.), Aurora, Ill.
Lewin Metals Corporation, St. Louis, Mo.
The Maytag Co., Newton, Iowa.
Michigan Smelting & Refining Co., Detroit, Mich.
National Bronze & Aluminum Foundry Co., Cleveland, Ohio.
National Smelting Co., Cleveland, Ohio.
Niagara Falls Smelting & Refining Corporation, Buffalo, N. Y.
Peninsular Smelting & Refining Co., Detroit, Mich.
South Bend Smelting & Refining Co., South Bend, Ind.
Standard Aluminum Castings Co., Lansing, Mich.
Stanley Chemical Co., East Berlin, Conn.
United States Aluminum Co., Cleveland, Ohio.
United States Reduction Co., East Chicago, Ind.

The use of No. 12 secondary ingots (92 per cent aluminum and about 8 per cent copper) has decreased, but an ever-increasing quantity of other alloys containing aluminum is being used. The difficulty in collecting, assorting, and smelting these alloys has forced secondary smelters to adopt more rigid chemical and metallurgical control. A surprisingly large quantity of old crank cases and other aluminum alloys is purchased by foundries for making castings that require no special purity of metal.

The following is the text of specifications for the purchase of aluminum scrap adopted by the members of the Aluminum Research Institute in March, 1930:

> The Aluminum Research Institute was organized several months ago by the major secondary aluminum smelters. The object of the organization is to improve and develop the business of manufacturing aluminum alloys and to endeavor to solve the problems which arise in connection with raw materials and with the making and distributing of aluminum alloys. The Institute is working out methods of standardizing the analysis of aluminum wastes and scrap because the assays by commercial laboratories and by smelters frequently do not check within reasonable limits.
>
> *Scrap aluminum castings.*—Shall consist of clean, heavy automobile castings, containing not more than 12 per cent industrial mixed castings both of which must be free from die cast aluminum, pistons, pattern metal and hat blocks. All of the above material also to be free from iron, babbitt, brass, and any other foreign substance. Oil and grease must not exceed 2 per cent.
>
> *Scrap sheet aluminum.*—Shall consist of clean, old, unalloyed sheet aluminum, guaranteed free from iron, dirt, and all foreign metals and substances.
>
> *Painted scrap sheet aluminum.*—Shall consist of clean, old, painted, unalloyed sheet aluminum, guaranteed free from iron, dirt, and all foreign metals and substances.
>
> *New aluminum (pure) clippings.*—Shall consist of new, clean, dry, unalloyed aluminum clippings and cuttings, free from punchings and all other foreign materials.
>
> *New aluminum alloy clippings.*—To be handled on specification or sample.
>
> *Aluminum pistons.*—Shall consist of clean aluminum pistons, free from iron and any other foreign substance.
>
> *New aluminum wire and cable.*—Shall consist of new, clean, dry, unalloyed aluminum wire or cable, free from iron, insulation, and any other foreign substance.
>
> *Old aluminum wire and cable.*—Shall consist of old, unalloyed aluminum wire or cable, containing not over 1 per cent free oxide or dirt, and free from iron, insulation, and any other foreign substance.
>
> *Aluminum borings.*—To be handled on specification or sample.
>
> *Aluminum drosses.*—To be handled on specification or sample.
>
> *Aluminum grindings, sawings, and sweepings.*—To be handled on specification or sample.
>
> *Aluminum spatters.*—To be handled on specification or sample.
>
> *Aluminum spinnings.*—To be handled on specification or sample.
>
> *Aluminum foil.*—To be handled on specification or sample.

The sources of aluminum and aluminum scrap alloys are as follows:

Clippings and sheets from utensils and automobile body works.

Foil, clean or coated.

Cable, clean or dirty.

Castings, pure or unalloyed, classified as (1) clean castings never in use, (2) dirty, reclaimed from machinery, and (3) dirty scrap cleaned.

Borings, turnings, etc. (machine shops convert 10 to 12 per cent of rough castings into fine particles; their value depends on cleanliness).

Skimmings from melting (they vary widely in metal content).

Grindings and buffings.

Sludge—residue from refining operations, usually worthless.

Dross—aluminous oxide and metal from fluxing operations.

Under normal conditions remelt ingot will sell at about 4 cents a pound below 99 per cent virgin ingot, clippings at 7.5 cents below virgin ingot, clean scrap castings 10 cents below virgin ingot, and borings 15 cents below virgin ingot.

A series of articles relating to aluminum is as follows:

Anderson, Robert J., Hughes, George E., and Anderson, Marshall B., Melting Aluminum in Large Quantities: Metal Ind., April, 1929, pp. 164–166.

Anderson, Robert J., The Contamination of Aluminum Scrap: Am. Metal Market, April 25, April 26, April 29, April 30, 1930.

Anderson, Robert J., Smelting Secondary Aluminum and Aluminum Alloys: Metal Ind., October, 1929, pp. 469–471; November, 1930, pp. 514–516.

Fullis, D. R., Developments in the Refinement of Secondary Aluminum: British Metal Ind., April 5, 1929, pp. 339–340; April 12, 1929, pp. 371–372.

A book[9] by Robert J. Anderson has recently been issued that should be of interest to all producers and consumers of aluminum and aluminum alloys.

SECONDARY NICKEL

Secondary nickel recovered in the United States, 1929 and 1930, in short tons

	1929	1930
Nickel recovered as metal	850	500
Nickel recovered in nonferrous alloys and salts	3,500	2,400
	4,350	2,900

Primary nickel produced in the United States and imported and exported, 1929 and 1930, in short tons

	1929	1930
Nickel produced as a by-product from the electrolytic refining of copper at domestic refineries	340	308
Nickel imported for consumption in the United States as nickel or in nickel ores and matte, oxide, and alloys	48,405	30,138
Nickel, Monel metal, and other alloys exported	1,435	1,420

The nickel reported as recovered from secondary sources includes nickel in Monel metal (a natural alloy) but not that in ferrous alloys.

The secondary nickel recovered in 1930, 2,900 tons, came mainly from scrap-nickel anodes, nickel silver, copper-nickel alloys, Monel metal, and nickel bronze. The greatest consumption of nickel in nonferrous alloys is for nickel silver, nickel plating, and malleable nickel. The secondary nickel recovered from nonferrous sources in the United States in 1930 was equivalent to 10 per cent of the nickel imported.

The quantity of nickel produced as a by-product from the electrolytic refining of copper was 32 tons less in 1930 than in 1929; the nickel imported for consumption, as nickel or in nickel ores, matte, oxide, and alloys, was 18,267 tons less in 1930 than in 1929.

The beneficial use of nickel in some brasses and bronzes has been set forth by metallurgists.[10] A. J. Wadhams, of the International Nickel Co., says that the practice of adding nickel to brass and bronze castings to improve their mechanical qualities is extending. Sales of primary nickel for this purpose have not been large, as intermediate alloys and white metal scrap are used extensively for making the nickel additions; however, the available supply of suitable white metal scrap has been dwindling and any increased use on the part of nonferrous foundries should be reflected in increased sales of primary nickel.

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[9] Anderson, R. J., Secondary Aluminum: The Sherwood Press (Inc.), Cleveland, Ohio, 1931, 563 pp.

[10] Pilling, N. B., and Kihlgren, G. E., Some Effects of Nickel on Bronze Foundry Mixtures: Metal Ind., June, 1931, p. 258.

Analyses of various nickel alloys were published in Mineral Resources, 1915.[11]

Considerable information as to the uses of nickel, Monel metal, and other nickel alloys is given in Inco, the publication of the International Nickel Co. This company purchases nickel scrap and Monel scrap. A flat offer is made for metal containing not less than 64 per cent nickel, not less than 27 per cent copper, not more than 3½ per cent iron, and not more than 0.05 per cent sulphur. The scrap must be free from lead and zinc. If the scrap offered is not up to above specification, settlement will be made on a basis of nickel and copper content. As the cost of sampling and analyzing is high, it is necessary to avoid small shipments of scrap, and not less than 500 pounds should be offered for sale.

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[11] Hess, F. L., Nickel: Mineral Resources of the United States, 1915, Pt. I, pp. 763-765.

TIN [1]

By CHARLES WHITE MERRILL [2]

CONTENTS

Page
General summary 355
Domestic production 358
  Alaska 358
  Other States 358
  Secondary tin 359
Imports and exports 360
  Metal and ore 360
  Tin manufactures 362
Consumption 364
  Tin plate and terneplate 366
  Automobile manufacture 367
Substitutes 368
Prices and stocks 369

Page
World production and resources 371
  Review by countries 375
    British Malaya 375
      Federated Malay States 375
      Straits Settlements 376
      Unfederated Malay States 377
    Bolivia 377
    Netherland East Indies 379
    Nigeria 380
    Siam 380
    China 381
    United Kingdom 382
    Other countries 382
World's tin smelters 383

GENERAL SUMMARY

The value of the tin required by the United States is much higher than that of any other mineral product furnished almost entirely by importation. Imports of tin in 1930 exceeded $60,000,000 in value, but domestic mine production was worth less than $11,000. Moreover, the value of the net imports of tin places that commodity among the ten leading domestic imports. The importance of a steady flow of tin into the United States is apparent when it is remembered that tin is indispensable to two of the largest domestic industries—automobile manufacture and canning.

The domestic production of tin in 1930 amounted to 15 long tons, valued at $10,500; of this, 13.1 tons came from Alaska and the remainder from North Carolina and South Dakota. However, the recovery of secondary tin—that is, the production of tin from sources other than ore—in the United States is very important, as more than one-fifth of the domestic supply of tin is now obtained in this manner.

Summary of statistics for tin in the United States, 1928–1930

	1928	1929	1930
Production long tons	42	35	15
Monthly price of Straits tin in New York:			
Highest cents per pound	55.64	49.37	38.91
Lowest do	47.10	39.79	25.27
Average do	50.46	45.19	31.70
Imports for consumption long tons	77,970	87,127	80,734
Exports (domestic and foreign) do	1,617	1,930	2,233
Reclaimed tin do	31,964	30,625	23,393

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[1] Work on manuscript completed September, 1931.

[2] Figures on imports into and exports from the United States compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The world production of tin (tin content of ore) in 1930 amounted to 174,000 long tons, a decrease of 9 per cent from the 192,000 tons produced in 1929, the record year. In spite of the decrease, however, the output in 1930 exceeded that in any year prior to 1928. The output of the three leading producing countries amounted to 134,816 tons, or more than 77 per cent of the world total; the Federated Malay States produced 62,065 tons, or nearly 36 per cent; Bolivia, 38,161 tons, or 22 per cent; and the Netherland East Indies, 34,590 tons, or nearly 20 per cent. The smelter production of tin was even more localized than the mine output, as the three leading tin-smelting countries—Straits Settlements, United Kingdom, and Netherland East Indies—produced about nine-tenths of the world total.

The principal supply to consumers in the United States enters the domestic market as imported refined pig tin, virtually all of which comes from four countries. The Straits Settlements furnished 69 per cent of the 1930 total; the United Kingdom, 15 per cent; the Netherlands, 9 per cent; and Hong Kong, 6 per cent. The imports of tin in 1930 amounted to 80,734 long tons, a decline of 7 per cent from the 87,127 tons imported in 1929 but greater than in any year before 1929. In value, however, tin imports dropped to a point below that in any year since 1922. This drop (34 per cent) in the total value of tin imports, from $91,838,781 in 1929 to $60,233,644 in 1930, was principally the result of the sharp fall in the price of the metal. During 1929 the price for Straits tin in New York averaged 45.19 cents a pound; in 1930 the price fell to an average of 31.70 cents, a decline of 30 per cent. The average price for 1930 was the lowest since 1921, and the average for December, 1930, was the lowest monthly average since 1902. In spite of such low prices tin fared better than several other common metals.

The world's "visible" stocks (in Government warehouses and in transit) continued to grow throughout most of the year and were a very depressing factor in the tin market. Visible stocks increased from 28,140 long tons on December 31, 1929, to 43,805 tons on August 31, 1930, the highest in the history of the industry. From June 30, 1930, until December 31, 1930, the fluctuations in visible stocks were very small, and the year closed with the stocks at 42,498 tons. Data concerning the change in stocks held by consumers, merchants, brokers, and others are not available. A minimum of 12,000 tons in "visible" stocks is considered necessary for undisturbed flow of tin from producers to consumers. In 1927 the monthly average of "visible" stocks was reduced to a quantity less than 3,000 tons above this minimum, thus placing the producers in a very favorable position. In 1930, however, this surplus was increased to more than 30,000 tons, thus giving the consumers a source of supply that allowed them to dominate the market.

The bulk of the tin consumption in the United States depends upon relatively few industries. The activity in these industries may be used as a rough index of the amount of tin being consumed. The principal tin-consuming industries are food packing, automobile manufacture, and building. The packing of food is relatively stable from year to year and may be counted upon to absorb a fairly constant quantity of tin plate and solder. The automobile industry is subject to wide variation both in the number of units produced and the proportion of high-tin-content to low-tin-content cars. The year 1930 marked a major recession in the productivity of the automobile industry; this recession probably was the most important factor in the decreased consumption of tin in the United States. The building trades are large users of terneplate, tin plate, and solder, and a variety of tin-bearing articles is employed in the equipment of new buildings. The building trades are subject to wide fluctuations in their tin requirements, and in 1930 the general depression was felt acutely.

The decreased consumption in the United States during 1930 was a very depressing factor on the tin market, and 1931 does not appear to offer much prospect of even equaling the tin consumption during 1930. Nevertheless, much of the curtailment during 1930 was for needs that ultimately will be supplied. Tin producers can therefore look forward with some degree of optimism, because much business, particularly in the building trades, is not lost but only postponed.

Throughout 1930 the Tin Producers' Association continued its efforts to control tin production and stabilize price. This organization, formed during the summer of 1928, did not obtain a substantial membership or begin its major activities until the close of that year. Its purpose was to stabilize the price of tin, an end which it proposed to accomplish by control of production, by research for new uses, and by publicity programs. Its greatest efforts were directed toward curtailment of production to offset the decline in consumption and the large and rising " visible " stocks. An energetic campaign pointing out the high cost of tin production was conducted. The benefits to be derived from production curtailment were emphasized. Several plans for effecting curtailment were proposed, but none appeared to be acceptable to all members of the association. Finally in 1930 a plan whereby each member would produce a quantity of tin not to exceed 80 per cent of that produced in 1929 was apparently adopted. Nevertheless, in spite of announcements by the association and by numerous producers that the 20 per cent curtailment program was in effect, the production in 1930 did not decline even 10 per cent. Some of this decline is perhaps due to the cessation of high-cost and weakly-financed operations; however, for some specific companies and areas the reduction in tin output is explained by compliance with the association's 20 per cent curtailment plan.

Toward the close of 1930 the ineffectiveness of the Tin Producers' Association led to a movement to have the governments of the principal tin-producing countries enforce a definite curtailment program. After several months of negotiations the Governments of the Federated Malay States, Bolivia, the Netherland East Indies, and Nigeria agreed to accept quotas for the total mine production of their respective countries and to enforce these quotas on their tin producers by law. The agreement called for a 2-year period of curtailment, with a semi-annual reconsideration of quotas, and became effective on March 1, 1931. Since then Siam has been induced to join this quota plan. The news of the adoption of the plan had only a minor effect upon the tin market, and many predict that all of 1931 will be required to reduce stocks sufficiently to make the plan very effective in raising the price of tin.

All tin miners do not agree as to the wisdom of the quota plan, but apparently so few have objected that their respective governments have felt justified in ignoring their complaints. The principal consumers of tin, with the exception of the British, had no representation in the negotiations that evolved the quota plan.

Aside from the organization of government forces for the benefit of tin miners, the present period is one of consolidation of producers, of diminished prospecting and development, and of less urgent need of replacing tin with substitutes.

DOMESTIC PRODUCTION

Although the United States has never been an important producer of tin it is not without producing deposits; nevertheless, careful studies of areas where tin has been produced or where it has been found, particularly during the World War period, indicate that this country can not expect to supply even an appreciable part of its requirements. The following table gives the domestic mine production for the past 10 years.

Tin mined in the United States (including Alaska), 1921–1930, in long tons

[Metallic tin obtainable from concentrates produced in tin mining]

1921	3.6	1926	7.14
1922	1.3	1927	24
1923	1.7	1928	42
1924	6.3	1929	35
1925	12.3	1930	15

Smelter output of metallic tin in the United States, 1921–1930, in long tons[a]

1921	10,305	1923	6,666
1922	8,132	1924	434

ALASKA

According to the United States Geological Survey, tin concentrates produced in Alaska in 1930 contained 13.1 long tons of tin, compared with 34.5 tons in 1929 and 36.6 tons in 1928. Placers near York on the Seward Peninsula 100 miles north of Nome were the principal producers. During recent years there have been prospecting and development work, with some production of tin ore, in the Hot Springs, Ruby, and Big Creek districts of the Yukon Valley. The present price of tin, however, is not likely to permit much expansion of the Alaska tin-mining industry. Alaska tin concentrates were shipped to Seattle, whence they were exported to the Straits Settlements for smelting.

OTHER STATES

The remaining domestic production was derived from the tin mines of North Carolina and South Dakota. There are, however, areas in California, Virginia, South Carolina, and Texas that have produced small quantities in the past, and tin minerals are known to occur in many other States.

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[a] No production recorded from 1925 to 1930.

SECONDARY TIN

The quantity of secondary tin recovered in the United States during 1930 was 23,393 long tons, a decline of 24 per cent from that recovered in 1929, and was equivalent to 29 per cent of the virgin tin imported in 1930. If the recovery of secondary tin were included with primary production the United States would rank fourth among the tin-producing countries of the world. The recovery of secondary tin, as metal, in alloys, and in chemical compounds, in the United States during the past 10 years has been as follows:

Secondary tin recovered as metal and in alloys and chemical compounds in the United States, 1921–1930 [1]

Year	Long tons	Value	Year	Long tons	Value
1921	15,089	$9,668,500	1926	29,821	$42,511,500
1922	17,420	12,443,500	1927	32,946	46,302,100
1923	26,973	25,316,000	1928	31,964	35,678,300
1924	27,946	31,062,100	1929	30,625	30,513,300
1925	27,634	35,165,400	1930	23,393	16,228,300

[1] Figures compiled by J. P. Dunlop, of the Bureau of Mines.

The quantity of secondary tin recovered fluctuates with industrial activity and the price of virgin tin. The depression of both these factors accounts for the decreased amount of tin recovered during 1930. The principal source of secondary tin is the scrap resulting from the manufacture of tin-bearing articles. The value of this type of scrap and of reclaimed junk depends upon the prices offered for the metals contained. When metal prices are at present levels the recovery of tin from much scrap, ordinarily valuable, is unprofitable.

Tin-bearing alloys, tin-plate clippings, and melting-pot drosses are the most important materials from which tin is reclaimed. Most of the tin recovered from alloys does not pass through a refined-tin stage but is made into alloys and brought to the required specifications by the addition of virgin metals.

Most of the tin plate entering the reclaiming processes is composed of trimmings incidental to the fabrication of tin cans. In the past some used tin cans have entered the detinning plants, but at the present prices for reclaimed metals the recovery of tin from this source is unprofitable in the United States.

At present the leading method used for the recovery of tin from tin plate is the chlorine process, which involves the exposure of clean, dry tin plate to dry chlorine gas. The tin is recovered as the chloride, much of which enters as such into the silk, pigment, and ceramic industries. The tin-free steel scrap residue is well suited for charging into basic open-hearth steel furnaces. The alkali method of detinning is also widely employed. In applying this method, clean tin plate is treated in a lye solution, which removes the tin coating as sodium stannate. The sodium stannate is converted into salable tin compounds or reduced to pig tin of high purity. The steel scrap is disposed of as in the chlorine process. The electrolytic method of detinning also is used to some extent.

IMPORTS AND EXPORTS

METAL AND ORE

The smelting of imported tin concentrates in the United States began in 1916. Tin concentrates were first imported for smelting in the United States in 1915, reached the high point both in quantity and value in 1920, and virtually ceased in 1924. The tin content of concentrates imported since 1924 has ranged from 122 to 303 long tons per year and was 289 tons in 1930. Inability to obtain clean concentrates to mix with the refractory Bolivia concentrates ended the United States tin-smelting industry, at least temporarily. The enormous local market, coupled with the proximity of Bolivia, should allow the United States to build up a large tin-smelting industry if a process for handling Bolivia concentrates economically, without admixture of clean ore, could be devised. The small quantity of concentrates produced in Alaska is shipped to Seattle, whence it is exported to Straits Settlements for smelting.

Tin concentrates imported into the United States, 1921–1930

[General imports]

Year	Long tons	Value	Year	Long tons	Value
1921	13,696	$5,672,861	1926	[1] 303	$187,396
1922	12,325	5,504,434	1927	[1] 122	79,089
1923	2,692	2,169,055	1928	[1] 130	69,227
1924	[1] 155	71,094	1929	[1] 128	66,609
1925	[1] 191	98,489	1930	[1] 289	177,120

[1] Recorded as tin content.

Tin content of tin ore, cassiterite, and black oxide of tin imported into the United States, 1929 and 1930, by countries

[General imports]

Country	1929		1930	
	Long tons	Value	Long tons	Value
Bolivia	6	$2,442		
Canada	121	63,484	62	$23,352
China	(1)	30		
France			(1)	9
Netherland East Indies ("Other")			(1)	5
United Kingdom	1	653	227	153,754
	128	66,609	289	177.120

[1] Less than 1 ton.

The quantity of tin (bars, pigs, blocks, grains, and granulated) imported into the United States in 1930 was 80,734 long tons, compared with 87,127 tons in 1929 and 77,970 tons in 1928. The quantity of tin imported in 1930 exceeded that in any previous year except 1929, but the value of tin imported was smaller than that in any year since 1922. More than 99 per cent of the tin imported in 1930 was supplied by British Malaya (Straits Settlements), the United Kingdom, the Netherlands, and Hong Kong; British Malaya was the source of 69 per cent of the tin imported, the United Kingdom 15 per cent, the Netherlands 9 per cent, Hong Kong 6 per cent, and seven other countries the remainder. The United Kingdom supplied a smaller proportion in 1930 than in 1929, but both British Malaya and Hong Kong increased their percentages.

Metallic tin imported for consumption in the United States, 1921–1930

Year	Long tons	Value	Year	Long tons	Value
1921	24,197	$16,645,719	1926	77,159	$104,793,396
1922	60,193	40,797,986	1927	71,142	100,865,205
1923	68,934	61,092,354	1928	77,970	86,983,174
1924	65,059	68,953,193	1929	87,127	91,838,781
1925	76,646	95,121,111	1930	80,734	60,233,644

Metallic tin (bars, pigs, blocks, grains, and granulated) imported into the United States, 1929 and 1930, by countries

[General imports]

Country	1929		1930	
	Long tons	Value	Long tons	Value
Australia	590	$628,889	236	$143,740
Canada	12	10,078	6	2,733
China	365	350,187	50	36,117
Germany	566	599,375	86	61,397
Haiti			(1)	72
Hong Kong	3,088	3,185,950	4,905	3,913,161
Malaya (British) (Straits Settlements)	58,219	61,322,731	55,739	41,326,304
Netherlands	7,522	8,216,715	7,374	5,844,535
Netherland East Indies:				
Java and Madura	270	292,983	163	122,504
Other			26	17,354
United Kingdom	16,494	17,231,435	12,149	8,765,727
Virgin Islands of the United States	1	438		
	87,127	91,838,781	80,734	60,233,644

[1] Less than 1 ton.

The exports of metallic tin, although relatively small, increased from 1,930 long tons in 1929 to 2,233 tons in 1930. Virtually all the tin exported was in the form in which it had been imported.

Metallic tin exported from the United States, 1921–1930, in long tons

Year	Domestic [1]	Foreign [2]	Year	Domestic [1]	Foreign [2]
1921	1,030	363	1926	675	1,305
1922	804	294	1927	1,010	1,229
1923	750	296	1928	349	1,268
1924	419	540	1929	790	1,140
1925	361	571	1930	84	2,149

[1] Imported as ore and exported as pigs, bars, etc.
[2] Imported as pigs, bars, etc., and exported as such.

TIN MANUFACTURES

The imports of tin plate, terneplate, and taggers tin in 1930 amounted to 261 long tons, valued at $67,102, compared with 285 tons, valued at $71,824, in 1929. Of the total in 1930, 74 per cent came from the United Kingdom and virtually all the remainder from Canada.

Tin plate, terneplate, and taggers tin imported into the United States, 1929 and 1930, by countries and by districts

	1929		1930	
	Long tons	Value	Long tons	Value
COUNTRY				
Canada	38	$9,703	69	$18,311
France			(1)	14
Germany	(1)	25	(1)	32
Soviet Russia in Europe	(1)	25		
United Kingdom	247	62,071	192	48,745
	285	71,824	261	67,102
DISTRICT				
Buffalo			1	179
Chicago	(1)	8		
Los Angeles	6	1,838	3	823
Maine and New Hampshire			(1)	25
Massachusetts	28	6,512	4	847
Michigan	16	3,711		
New York	30	6,150	18	4,950
Ohio	9	2,180	19	4,695
Oregon	7	1,971	2	594
Philadelphia	70	18,035	72	18,191
St. Lawrence	10	2,773	38	10,418
San Francisco	5	1,372	7	2,091
Vermont	50	12,219	33	8,341
Washington	1	368		
Wisconsin	53	14,687	64	15,948
	285	71,824	261	67,102

[1] Less than 1 ton.

The exports of tin plate, terneplate, and taggers tin amounted to 216,516 long tons, valued at $24,201,977, in 1930, compared with 258,964 tons, valued at $28,566,189, in 1929. Both in quantity and value the exports were below those in any year since 1925. The countries receiving the larger part of the exports in 1930 were as follows: Canada, $6,719,553; Japan, $4,734,122; China, $1,870,774; Argentina, $1,445,464; Mexico, $1,249,458; India, $1,153,831; Italy, $904,971; and the Philippine Islands, $833,392. Large decreases in the exports to most oriental countries were principally responsible for the reduction in total exports. The substantial decrease in quantity exported to Japan was approximately the same as in that to China, and the sum of these decreases was nearly equal to the total decline in exports. Argentina also showed a marked decrease, but important increases were recorded in exports to Canada, Italy, Uruguay, and Mexico.

Tin plate, terneplate, and taggers tin exported from the United States, 1929 and 1930, by countries and by districts

	1929		1930	
	Long tons	Value	Long tons	Value
COUNTRY				
North America:				
Barbados	37	$2,602		
Canada	46,213	5,533,681	55,780	$6,719,553
Central America—				
Costa Rica	11	1,623	4	538
Guatemala	62	7,470	2	276
Honduras	1	169	1	64
Nicaragua	6	849	1	57
Panama	4	591	2	299
Salvador	18	2,440	18	2,564
Mexico	10,901	1,184,769	11,688	1,249,458
Miquelon and St. Pierre Islands	41	3,997		
Newfoundland and Labrador	101	10,109	99	10,756
West Indies—				
British—				
Jamaica	22	2,449	38	3,947
Trinidad and Tobago	130	13,369	1	140
Other			3	316
Cuba	5,517	597,224	4,842	527,914
Dominican Republic	17	2,232	11	1,540
Haiti	4	494	2	221
Netherland	394	41,625	357	38,491
South America:				
Argentina	20,687	2,103,021	14,216	1,445,464
Bolivia	9	964		
Brazil	3,927	389,229	2,874	297,499
Chile	5,670	589,957	5,517	584,513
Colombia	1,033	119,951	906	101,334
Ecuador	5	888		
Guiana, Netherland (Surinam)	115	11,339		
Peru	6,413	675,162	3,545	362,383
Uruguay	4,743	482,725	6,574	676,474
Venezuela	167	18,156	336	37,954
Europe:				
Belgium	21	2,168		
Bulgaria	34	3,764	464	51,721
Denmark	297	29,830	28	3,367
France	5	695	(1)	49
Greece	3,145	340,406	1,792	194,492
Italy	5,688	620,486	7,938	904,971
Netherlands	116	11,239	1	180
Norway	13	1,251		
Portugal	60	6,203	90	9,570
Soviet Russia	1,133	155,960	2,294	274,623
Sweden	497	48,464	29	2,933
United Kingdom	155	17,538	188	18,774
Yugoslavia			218	24,939
Asia:				
Ceylon	92	10,220	157	16,990
China	37,734	3,987,781	17,500	1,870,774
East Indies—				
British—				
India	10,034	1,103,118	10,660	1,153,831
Malaya (Straits Settlements)	1,932	212,058	2,282	241,311
Netherland—				
Java and Madura	2,821	307,270	3,046	344,897
Other	694	76,776	1,586	164,182
Hong Kong	5,316	526,527	4,102	425,242
Iraq	(1)	57		
Japan (including Chosen)	61,811	6,987,765	41,040	4,734,122
Kwantung	134	12,028	846	88,923
Palestine	52	4,141		
Philippine Islands	8,661	916,509	7,765	833,392
Soviet Russia	3,005	402,036		
Syria	1,005	103,112	2,873	291,911
Turkey	3,023	333,190	1,745	184,005
Africa:				
British—Union of South Africa	567	58,584	529	51,580
Egypt	4,658	487,588	2,269	237,934
Morocco			80	8,932
Portuguese—Mozambique			167	5,238
Oceania (British):				
Australia	12	2,190	9	1,165
New Zealand	1	150	1	174
	258,964	28,566,189	216,516	24,201,977

Tin plate, terneplate, and taggers tin exported from the United States, 1929 and 1930, by countries and by districts—Continued

	1929		1930	
	Long tons	Value	Long tons	Value
DISTRICT				
Arizona	62	$6,372	157	$15,970
Buffalo	29,782	3,605,420	34,407	4,172,387
Chicago	864	98,311	44	5,384
Dakota	2,163	255,716	5,032	617,611
Duluth and Superior	383	42,671	393	49,961
El Paso	2	350	1	206
Florida			(¹)	1
Los Angeles	225	9,194	23	2,811
Maine and New Hampshire	180	20,542	1	155
Maryland	91,018	9,781,644	71,827	7,700,409
Michigan	1,227	136,454	1,456	158,186
Montana-Idaho			17	1,761
New Orleans	110	8,677	189	18,274
New York	99,735	10,951,736	75,320	8,316,757
Ohio	8,780	1,074,302	11,969	1,448,145
Oregon	150	11,548	109	12,129
Philadelphia	17,752	1,856,088	9,609	1,019,422
Rochester	1	287	(¹)	12
Sabine	(¹)	28		
St. Lawrence	928	97,128	232	23,700
San Antonio	781	87,730	1,797	198,302
San Francisco	1,797	163,238	1,049	110,874
Vermont	951	108,859	1,830	194,333
Virginia	30	3,764		
Washington	2,013	246,130	1,054	135,481
	258,964	28,566,189	216,516	24,201,977

[1] Less than 1 ton.

Much tin also is exported from the United States in manufactures, little of whose value is derived from the tin they have consumed incident to production. The most important of such exports are products of the automotive and the food-packing industries. There are no statistics on the quantity of tin thus exported, but estimates based on the total exports of these products indicate that it is considerable.

CONSUMPTION

The United States is the world's leading consumer of tin, due largely to its supremacy in the canning and motor-vehicle industries. The Bureau of Mines has canvassed the domestic tin-consuming industries to ascertain their annual consumption and stocks of virgin tin in the years 1927, 1928, and 1930.[4] The results of this work are presented in the following table and text. As the earlier estimates of the War Industries Board (1917) and the Bureau of Mines (1925)[5] included secondary tin they are not comparable with the following figures.

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[4] Umhau, J. B., Consumption of Primary Tin in the United States during 1930: Inf. Circ. 6561, Bureau of Mines, 1932, 7 pp.

[5] Furness, J. W., Consumption of Tin in the United States, 1925: Inf. Circ. 6019, Bureau of Mines, 1927, 3 pp.

Virgin tin consumed in the United States, 1927, 1928, and 1930, by uses

Use	1927		1928		1930	
	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total
Tin plate and terneplate	24,525	35.96	27,053	36.38	27,753	42.40
Solder	13,602	19.94	[1] 13,874	18.66	11,407	17.43
Babbitt	7,595	11.14	[1] 8,150	10.96	5,438	8.31
Bronze	4,664	6.84	[1] 4,324	5.81	3,499	5.35
Foil	4,193	6.15	5,068	6.81	3,061	4.68
Collapsible tubes	2,710	3.97	2,864	3.85	[2] 3,826	5.84
Chemicals	[1] 2,621	3.84	4,246	5.71	3,268	4.99
Tin oxide	1,311	1.92	1,183	1.59	666	1.02
Tinning (brass, copper tubes, sheets, shells, wire, nails, etc.)	2,661	3.90	2,636	3.54	2,814	4.30
White metal	849	1.25	802	1.08	1,117	1.71
Type metal	450	.66	[1] 411	.55	223	.34
Castings	1,011	1.48	730	.98	[3] 74	.11
Other alloys	[1] 556	.82	629	.85	306	.47
Miscellaneous	1,450	2.13	[1] 2,399	3.23	1,996	3.05
	68,198	100.00	[1] 74,369	100.00	65,448	100.00

[1] Revised figures.

[2] Not comparable with preceding years owing to the canvassing of several additional users whose consumption was not included previously.

[3] Pure tin castings only; in preceding years some tin-alloy castings were reported under this heading.

Virgin tin consumed in the United States amounted to 65,448 long tons in 1930, compared with 74,369 tons in 1928 and 68,198 tons in 1927. The decline of 12 per cent from 1928 to 1930 was unevenly distributed among the uses of tin. The manufacture of tin plate and terneplate actually required more tin in 1930 than in 1928. This is explained, at least in part, by the almost depression-proof nature of the chief consumer of tin plate, the canning industry. The consumption of canned goods apparently has not been affected by the depression. The quantities of virgin tin consumed for tinning and for making white metal in 1930 increased over those in 1928. For all other important uses of tin, however, the consumption of virgin tin has shown marked decrease.

The largest decrease in quantity of tin used was in the babbitt business, where consumption fell off one-third. This sharp drop resulted largely from the great decline in the manufacture of automobiles. The consumption for solder and bronze also was adversely affected by the automobile business, although the consumption of solder was sustained to some extent by the canning industry.

The manufacture of foil required only three-fifths as much tin in 1930 as in 1928 as a result of several factors, the most important probably being substitution of other materials as wrappers in place of tin foil. The decrease in the consumption of tin for chemicals was caused, in part at least, by the decline in the consumption of silk.

The consumption of secondary tin can not be segregated by various uses in as much detail as that of the virgin metal. Much secondary tin is consumed in the form of alloys by companies that are unable to report the exact tin content of the materials they consume. Less than one-fourth of the total secondary tin is recovered as metallic tin before reuse. The principal use of secondary tin is in the manufacture of alloys, and most of it so used is reclaimed from secondary alloys without first being converted into the pure metallic state. The alloy scrap is sorted to remove undesirable elements, is melted and analyzed, and then receives sufficient virgin metals to bring the molten mass to the analysis desired. The tin-alloy store of the United States can best be represented as a reservoir, containing many metals, into which a stream of virgin tin must constantly flow to replace losses and provide for expansion.

Secondary tin also plays an important part in supplying the tin requirements of the chemical industry. The fact that the tin on tin plate can be converted directly to tin chloride by the chlorine process accounts for the importance of secondary tin in the chemical industry, as tin chloride is used for the weighting of silk.

The consumption of virgin tin can be approximated by calculations based upon production, imports, exports, and stocks. The following table presents the available data for the computation of "apparent" consumption.

Apparent consumption of virgin tin in the United States, 1928–1930, in long tons

	1928	1929	1930
Supply:			
Domestic production	42	35	15
Imports of tin as metal	77, 970	87, 127	80, 734
Imports of tin in concentrates	130	128	289
Visible stocks, Jan. 1	1, 573	2, 428	2, 820
Consumers' stocks, Jan. 1	9, 215	8, 534	10, 606
Total available	88, 930	98, 252	94, 464
Withdrawals:			
Exports of tin as metal	1, 617	1, 930	2, 233
Exports of tin in concentrates	36	35	15
Visible stocks, Dec. 31	2, 428	2, 820	4, 693
Consumers' stocks, Dec. 31	8, 534	10, 606	15, 500
Total withdrawn	12, 615	15, 391	22, 441
Apparent consumption	76, 315	82, 861	72, 023
Consumption accounted for in Bureau of Mines canvass	74, 369	[1]	65, 448

[1] No canvass by Bureau of Mines for 1929.

The principal difficulty in these figures for apparent consumption is that all stocks are not either "visible" or in the possession of consumers. The so-called "invisible" stocks other than consumers' stocks, however, probably are relatively unimportant in the United States because of the lack of widespread interest in speculation in tin.

Another difficulty of minor importance results from the probable inclusion of some secondary tin in consumers' stocks. Apparent consumption is therefore only an approximation of actual consumption and may vary considerably from the figure it seeks to approximate.

TIN PLATE AND TERNEPLATE

The tin-plate and terneplate industry is the largest consumer of virgin tin in the United States, having consumed more than one-third of the total virgin tin used in 1927 and in 1928 and having increased its requirements to 42 per cent of the total used in 1930. The greater importance of the tin-plate and terneplate industry in 1930, however, resulted largely from the decline of many other tin-consuming industries, as the quantity of tin consumed in tin plate and terneplate increased less than 3 per cent in 1930 as compared with 1928.

Tin plate is made by coating steel sheets with pure tin, and in present practice standard tin plate contains about 1½ per cent of tin by weight. One pound of tin will make 220 square feet of tin plate. Terneplate is similar to tin plate, except that an alloy of lead and tin is substituted for pure tin in the coating. Taggers tin is extra-thin tin plate. The larger part of the tin plate and taggers tin manufactured is used for making tin cans, particularly food containers. Terneplate is largely used for roofing and for gasoline tanks on automobiles, and some is substituted for tin plate in nonfood-product containers, where the toxic effect of the lead is not deleterious.

In 1930 tin was used in the manufacture of 1,660,325 long tons of tin plate and 103,118 tons of terneplate in the United States, compared with 1,816,223 and 152,057 tons, respectively, in 1929. Exports of tin plate, terneplate, and taggers tin amounted to 216,516 long tons in 1930, a decline of 16 per cent from the 258,964 tons exported in 1929. Imports of tin plate, terneplate, and taggers tin continued to be negligible in amount. The United States produces nearly twice as much tin plate and terneplate as the United Kingdom, but exports only about one-half as much as that country.

The fact that consumption of tin for tin plate and terneplate increased slightly in 1930 as compared with 1928 while there was a 4 per cent decline in the production of tin plate and terneplate undoubtedly is principally the result of increasing the thickness of the tin coating. During the period of high tin prices the tin coating was reduced to a minimum, but lower tin prices have encouraged tin-plate manufacturers to improve the quality of their product by thickening the protective coating.

Tin plate and terneplate produced in the United States, 1921–1930, in long tons[1]

Year	Tin plate	Terneplate	Total	Year	Tin plate	Terneplate	Total
1921	747, 911	46, 363	794, 274	1926	1, 674, 322	107, 984	1, 782, 306
1922	1, 208, 772	79, 123	1, 287, 895	1927	1, 583, 383	105, 066	1, 688, 449
1923	1, 414, 404	92, 458	1, 506, 862	1928	1, 714, 990	124, 215	1, 839, 205
1924	1, 328, 228	90, 426	1, 418, 654	1929	1, 816, 223	152, 057	1, 968, 280
1925	1, 544, 007	113, 788	1, 657, 795	1930	1, 660, 325	103, 118	1, 763, 443

[1] From Annual Report of American Iron and Steel Institute.

AUTOMOBILE MANUFACTURE

The automobile industry consumes a quantity of tin equivalent to almost one-seventh of that imported. According to the National Automobile Chamber of Commerce,[6] 11,000 long tons of tin were consumed by this industry in 1930, compared with 21,000 tons in 1929 and 19,000 tons in 1928. The number of motor vehicles produced in 1930 was the lowest since 1922 and a 37 per cent decline from the record year, 1929. An even lower production is expected for 1931. The chief uses of tin in automobile manufacture are in babbitt for engine bearings, solder for radiators, and bronzes for bearings and bushings.

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[6] National Automobile Chamber of Commerce, Facts and Figures of the Automobile Industry: New York, editions 1929, 1930, and 1931, p. 13 (1929 ed.), p. 83 (1930 ed.), and p. 83 (1931 ed.).

The number of motor vehicles registered in 1930 was eight times the number of new units manufactured, and their maintenance and repair constitute a very substantial factor in the consumption of tin. Although there are no adequate figures upon which to base exact conclusions, it is undoubtedly safe to state that radiators and babbitt bearings require a larger percentage of repairs and replacements than most other metallic parts of the average motor vehicle. In this connection it may be noted that the universal use of pumps for circulating oil in the crank case and water in the radiator in the current models should decrease the use of tin replacements and repairs. These refinements in design, together with economies in the initial use of tin, may actually decrease the future requirements of tin in spite of probable increasing motor-vehicle use and production.

Production, registration, and exports of motor vehicles in the United States, 1922–1930

Year	Production [1]			Registration [2] (all classes)	Exports [3] (all classes)
	Passenger cars	Trucks and busses	Total		
1922	2, 274, 185	269, 991	2, 544, 176	12, 421, 000	78, 234
1923	3, 624, 717	409, 295	4, 034, 012	15, 264, 000	151, 894
1924	[4] 3, 185, 881	416, 659	3, 602, 540	[5] 17, 748, 000	178, 732
1925	[4] 3, 735, 171	530, 659	4, 265, 830	[5] 20, 078, 000	302, 951
1926	[4] 3, 783, 987	516, 947	4, 300, 934	[5] 22, 133, 000	305, 420
1927	[4] 2, 936, 533	464, 793	3, 401, 326	[5] 23, 254, 000	384, 195
1928	[4] 3, 815, 417	543, 342	4, 358, 759	[5] 24, 611, 000	507, 097
1929	[4] 4, 587, 400	771, 020	5, 358, 420	[5] 26, 616, 000	536, 207
1930	[4] 2, 784, 745	571, 241	3, 355, 986	[5] 26, 632, 000	237, 582

[1] Bureau of the Census.
[2] Bureau of Public Roads.
[3] Bureau of Foreign and Domestic Commerce.
[4] Includes taxicabs.
[5] Includes road tractors, not previously reported.

Smaller but increasingly important users of tin and its alloys are the manufacturers of airplanes, motorships, and stationary Diesel engines. All these products require tin in their manufacture and for much the same purposes as do automobiles. The rapidly increasing manufacture of electric refrigerators should prove an outlet of growing importance for tin, as these products utilize heavily tinned racks and trays as well as much tin in the refrigerating units.

SUBSTITUTES

A few years ago, when the price of tin was approximately double what it averaged during 1930, the opinion was widely expressed that the reserves of tin, marketable at the prices then current, were very limited. Intensive research for substitutes resulted. The field for making important substitutions seemed very promising, because at that time tin was the highest-priced metal in the common base-metal group. Since then the fall in the price of tin and the growing tin stocks have refuted the opinion that tin reserves are very limited at present; in consequence, the search for substitutes has diminished. Nevertheless, many of those who are concerned with the supply of tin in the more distant future can not escape the opinion that adequate supplies of tin may require the payment of prices much higher than those now current. Moreover, domestic consumers must depend upon substitutes as one of their most effective means for maintaining reasonable tin prices as well as one of their principal means for continued production if war should curtail the flow of tin to the United States.

Much study has been given the problem of finding a substitute for tin plate in the canning industry, but to date no tin-free container has been developed that can offer serious competition to the tin can. Glass containers have been used successfully where the advantage of display of contents has outweighed the higher initial cost and difficulties of transportation. Experiments have been made with stainless steel cans, but the high cost and the difficulties of opening have made their use uneconomical. Research to develop a practical aluminum can continues. So far the aluminum products have been not only costly but have failed to resist the rough handling to which the ordinary can is subject. Research in the substitution of lacquers for tin in the manufacture of tin cans has made little progress because of the difficulty in obtaining an appearance of cleanliness and beauty equal to that of the tin, as well as the difficulty in duplicating the purely utilitarian qualities of the tin coating.

In the manufacture of alloys the aluminum brasses have displaced some of the tin-bearing bronzes, but in the making of other bearing metals and solders the displacement of tin seems to have been of little importance. The savings effected have depended upon more economical use of the alloys. Attention has been given to decreasing the amount of tin alloy entering bearings, and joints to be soldered are being fitted more carefully to avoid unnecessary filling in with solder.

Aluminum is being used as a substitute for tin in the manufacture of foils and collapsible tubes. The fields where lead is excluded because of its toxic properties are now being invaded by aluminum. Because of its low specific gravity a given weight of aluminum will make much more foil of a given gage than an equal weight of tin. but this advantage is offset in some tin foils by rolling from bars containing a lead core. Tin foil is also meeting severe competition as a food and cigar wrapper in "cellophane," a transparent cellulose product, and in various waxed papers.

The further introduction of ball and roller bearings, particularly in railroad rolling stock, has cut into fields once held almost exclusively by babbitt and related bearing metals.

The substitution of rayon for silk tends to lessen the use of tin, as rayon, unlike silk, does not require the use of tin salts in preparation for dyeing and in weighting.

PRICES[7] AND STOCKS

The break in the tin market that started in April, 1927, continued with only minor recoveries until a low monthly average of 25.27 cents a pound was reached in December, 1930. Thus, the average monthly price recorded for December, 1930, represented a decline of 64 per cent from the high monthly average of 70.67 cents a pound recorded for November, 1926. The tin-price record for the year 1930 includes a high monthly average of 38.91 cents for January, a low monthly average of 25.27 cents for December, and an average for the year of 31.70 cents, compared with the record for 1929 of a high average monthly price of 49.37 cents for February, a low average monthly price of 39.79 cents for December, and an average for the year of 45.19 cents. The average for the year 1930 was thus 13.49 cents (30 per cent) less than that for 1929. The average price for December, 1930, was 14.52 cents (36 per cent) below that for the closing month of 1929.

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[7] Prices used in this discussion refer to Straits tin in New York, as quoted in the American Metal Market and published in Metal Statistics, 1931, pp. 337 and 339.

Monthly price of Straits tin for prompt delivery in New York, 1928–1930, in cents per pound [1]

	1928			1929			1930		
	High	Low	Average	High	Low	Average	High	Low	Average
January	57.75	54.25	55.64	49.87½	48.50	49.16	39.75	37.80	38.91
February	54.50	51.12½	52.49	50.37½	48.80	49.37	39.20	37.75	38.67
March	53.87½	50.25	52.18	49.62½	48.37½	48.85	37.90	35.85	36.81
April	53.87½	51.12½	52.36	48.75	43.75	45.97	37.20	34.00	36.07
May	52.50	49.87½	51.54	44.62½	43.37½	43.92	33.25	31.25	32.13
June	49.75	45.75	47.96	44.75	43.50	44.26	31.12½	29.50	30.30
July	49.00	46.00	47.10	47.50	44.70	46.40	30.37½	29.15	29.81
August	48.87½	47.25	48.08	47.37½	46.12½	46.65	30.35	29.60	30.02
September	49.75	47.00	48.07	45.87½	45.00	45.38	30.00	28.70	29.64
October	50.00	48.25	49.01	44.25	40.37½	42.35	28.00	24.75	26.86
November	53.00	49.25	50.85	41.87½	39.12½	40.22	26.75	25.20	25.89
December	53.25	49.37½	50.21	41.75	38.37½	39.79	26.87½	23.75	25.27
Year	57.75	45.75	50.46	50.37½	38.37½	45.19	39.75	23.75	31.70

[1] Metal Statistics, 1931, pp. 337 and 339.

Although the average price for 1930—31.70 cents a pound—may seem low when compared with the averages for the years immediately preceding, it may be noted that this price is virtually the same as the average price recorded for both 1921 and 1922. Nevertheless, it also may be noted that the price of tin since 1900 has averaged 11 cents above that for 1930.

The following table shows tin-plate, pig-tin, and sheet-bar price changes since 1921 on the dates listed.

Changes in prices for tin plate at Pittsburgh, pig tin at New York, and sheet-bar tin at Pittsburgh, 1921–1930 [1]

Date	Tin plate (per base box)	Pig tin (per pound)	Sheet bars (per long ton)	Date	Tin plate (per base box)	Pig tin (per pound)	Sheet bars (per long ton)
1921:		*Cents*				*Cents*	
Apr. 13	$6.25	29.25	$39.00	1924: Nov. 25	$5.50	54.37½	$37.00
June 14	5.75	29.37½	39.00	1925: Nov. 19	5.50	63.50	35.00
July 29	5.25	26.62½	32.00	1926: Nov. 9	5.50	71.00	36.00
Nov. 3	4.75	28.00	30.00	1927: Nov. 30	5.25	58.62½	34.00
1922. Nov. 23	4.75	36.00	36.50	1928: Nov. 15	5.35	50.12½	34.00
1923:				1929:			
Feb. 26	4.95	44.25	40.00	Nov. 15	5.35	39.87½	34.00
Apr. 26	5.50	44.12½	45.00	Dec. 31	5.25	39.75	34.00
Nov. 1	5.50	41.87½	42.50	1930: Oct. 1	5.00	28.00	31.00

[1] Metal Statistics, 1931, p. 145.

The monthly average of the world's "visible supply" of tin has been as follows: 1927, 14,925 long tons; 1928, 18,392 tons; 1929, 25,481 tons; and 1930, 38,621 tons. The supply followed a fairly regular downward trend from the high yearly average of 24,682 tons for 1922 to the low monthly average of 13,352 tons for August, 1926. Stocks remained at approximately this figure until April, 1928, when, except for a drop in June, there was a steady increase to the end of 1928. Stocks remained relatively constant from then until December, 1929. A second period of increasing stocks began in December, 1929, and continued until August, 1930, when the total had reached 43,805 tons, the highest that ever had been recorded. During the rest of the year stocks remained near this high level. These large and increasing stocks were a major factor in depressing the price of tin.

The visible supply held in the United States has averaged approximately 2,500 tons for many years, seldom dropping below 1,500 tons and seldom exceeding 5,000 tons. During 1930, however, visible stocks approximately doubled, but even this larger supply would have satisfied the requirement of industry for less than four weeks. The lower price of tin and the increasing activity in the National Metal Exchange probably are the principal factors accounting for the increased tin stocks.

The so-called invisible stocks of tin are exceedingly difficult to estimate, as they consist largely of stocks held by consuming manufacturing companies and by metal merchants and speculators. Examination of the questionnaires that have formed the basis of the Bureau of Mines studies of the tin consumption since 1928 indicates that manufacturing requirements rather than current price of the metal determine the stocks carried by consumers of virgin tin in the United States. Nevertheless, it may be noted that stocks held by consumers increased by almost one-half during 1930. At the end of 1930 the consumers had supplies of tin sufficient to last two and one-half months at the average rate of consumption prevailing during 1930.

WORLD PRODUCTION AND RESOURCES

The world production of tin in 1930 was 174,000 long tons, compared with 192,000 tons in 1929, 178,000 tons in 1928, and 159,000 tons in 1927. The decrease in world production is largely accounted for by the smaller outputs of Bolivia, the Federated Malay States, and Nigeria, where many companies had curtailed operations in response to the Tin Producers' Association's program for reducing supply to demand. Several countries having smaller outputs also contributed to the reduction in world production. The Netherland East Indies and Siam were the only large producers to maintain production at the 1929 level.

World production of tin (content of ore), 1926-1930, by countries, in long tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
Australia	2,860	3,144	2,890	2,259	1,451
Belgian Congo	1,145	873	785	881	591
Bolivia [1]	30,061	35,808	41,409	46,343	38,161
China [1]	6,509	6,220	7,033	6,778	6,483
England—Cornwall	2,327	2,593	2,761	3,271	2,488
India (British)	2,484	2,447	1,946	2,649	2,719
Indo-China	551	699	796	829	992
Japan [2]	537	669	733	789	[3] 800
Malay States:					
Federated [1]	45,948	52,180	61,935	67,042	62,065
Unfederated [1]	1,773	2,047	2,680	2,326	1,910
Netherland East Indies	32,234	34,487	35,660	35,236	34,590
Nigeria	7,417	8,056	9,132	10,742	8,696
Portugal	758	695	678	(4)	(4)
Siam	7,487	7,584	7,572	10,517	11,060
Union of South Africa	1,111	1,147	1,249	1,218	930
Other countries [5]	500	800	900	1,500	1,500
	144,000	159,000	178,000	192,000	174,000

[1] Exports.
[2] Smelter product.
[3] Approximate production.
[4] Less than 500 tons; included under "Other countries."
[5] Includes countries producing less than 500 tons.

The reduction in world tin production did not result from the exhaustion of important deposits but from the closing down of operations made unprofitable by the lower price of tin and from the curtailing of output by companies practicing the recommendations of the Tin Producers' Association. In spite of both these factors the reduction was comparatively small—9 per cent.

World trade in metallic tin, 1929 and 1930, in long tons [1]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1929												
Shipments from—												
Straits	8,394	7,788	8,145	8,950	9,139	8,713	7,906	8,978	6,608	8,274	10,174	8,950
Australia	120	109	107	101	96	89	88	90	95	90	90	80
Banka and Billiton	697	1,741	1,554	1,549	577	624	828	1,003	1,353	1,210	839	1,276
China	335	280	896	635	30	50	185	365	260	205	250	405
Bolivia [2]	3,180	3,039	1,566	5,124	3,804	5,190	3,354	3,261	4,080	3,366	3,315	4,062
Nigeria [2]	868	762	882	1,153	1,025	792	676	658	879	958	932	827
	13,594	13,719	13,150	17,512	14,671	15,458	13,037	14,355	13,275	14,103	15,600	15,600
Deliveries to—												
United Kingdom	1,252	754	1,326	1,597	1,491	1,674	1,780	1,198	1,514	1,676	2,758	1,861
United States of America	8,795	6,750	8,175	8,435	8,480	7,455	6,865	7,185	8,120	6,515	6,595	5,740
Continental Europe	2,237	1,879	2,254	2,413	2,532	2,015	1,947	1,665	2,486	2,092	2,106	2,145
All others	593	719	590	573	762	841	409	513	373	757	789	1,099
	12,877	10,102	12,345	13,018	13,265	11,985	11,001	10,561	12,493	11,040	12,248	10,845
Visible supply:												
Total—												
Shipments (loadings)	9,546	9,918	10,632	11,192	9,637	9,467	9,007	10,436	8,316	9,779	11,353	10,321
Afloat	3,817	4,408	4,695	3,394	2,915	2,238	2,381	3,373	3,421	2,572	2,091	1,980
Landing	2,266	2,812	1,998	2,635	3,149	2,955	2,590	2,455	2,281	2,092	1,772	3,209
In warehouse	8,608	9,264	9,307	9,132	9,064	9,091	9,811	10,136	10,538	11,137	9,955	12,630
	24,237	26,402	26,632	26,353	24,765	23,751	23,789	26,400	24,556	25,580	25,171	28,140
By countries—												
United Kingdom—												
Afloat—												
Straits	710	1,298	903	1,125	840	1,603	920	915	1,003	1,990	1,885	1,625
Australia	35	71	54	44	42	44	87	40	93	67	40	60
Netherland East Indies	52	832	1,028	816	244	78	214	298	104	42	84	98
Stocks—All others	8,263	8,769	8,755	8,164	8,749	8,226	9,314	9,733	10,340	10,509	9,677	13,019
	9,060	10,970	10,740	10,149	9,875	9,951	10,535	10,986	11,540	12,608	11,686	14,802

[1] Compiled from reports of the London Metal Exchange.
[2] Calculated metallic tin content of ore and concentrates to the United Kingdom only (arrivals).

World trade in metallic tin, 1929 and 1930, in long tons—Continued

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1929												
Visible supply—Con.												
By countries—Contd.												
United States of America—												
Afloat	9,196	8,920	10,059	8,932	7,766	6,408	6,922	9,685	7,530	6,561	7,336	7,041
Stocks and landings	2,611	3,307	2,550	3,603	3,464	3,820	3,087	2,858	2,479	2,720	2,050	2,820
	11,807	12,227	12,609	12,535	11,230	10,228	10,009	12,543	10,009	9,281	9,386	9,861
Continental Europe—												
Afloat—												
Straits	2,514	2,400	2,347	2,450	3,144	2,883	2,513	2,098	1,758	2,494	3,229	2,315
Netherland East Indies	856	805	936	1,204	516	689	732	773	1,249	1,197	870	1,162
Others	------	------	------	15	------	------	------	------	------	------	------	------
	3,370	3,205	3,283	3,669	3,660	3,572	3,245	2,871	3,007	3,691	4,099	3,477
Total visible supply	24,237	26,402	26,632	26,353	24,765	23,751	23,789	26,400	24,556	25,580	25,171	28,140
1930												
Shipments from—												
Straits	8,229	9,361	7,795	9,720	10,074	8,156	7,391	7,849	5,308	7,349	8,540	7,065
Australia	55	95	65	65	35	25	20	------	------	55	65	55
Netherland East Indies	1,191	854	538	1,119	782	1,591	863	883	401	795	1,202	4,391
China	655	405	545	145	80	40	200	419	466	593	317	448
Bolivia [2]	3,426	4,575	2,889	1,719	3,294	3,549	2,406	2,274	2,445	2,568	2,871	3,024
Nigeria [2]	958	851	1,230	969	764	548	687	595	460	670	447	513
	14,514	16,141	13,062	13,737	15,029	13,909	11,567	12,020	9,080	12,030	13,442	15,496
Deliveries to—												
United Kingdom	2,108	1,478	1,345	1,647	1,439	1,486	1,332	1,324	1,080	1,322	1,032	954
United States of America	5,815	4,940	8,675	6,780	5,710	5,885	6,130	5,695	7,250	7,580	6,270	7,495
Continental Europe	2,353	1,824	1,881	1,609	2,229	2,388	3,444	2,155	1,982	1,194	2,155	2,027
All others	738	721	299	781	607	724	738	714	858	523	981	992
	11,014	8,963	12,200	10,817	9,985	10,483	11,644	9,888	11,170	10,619	10,438	11,468
Visible supply:												
Total—												
Shipments (loadings)	10,040	10,715	8,838	11,049	10,816	9,727	8,474	9,151	6,105	8,792	10,079	11,934
Afloat	2,055	4,252	4,241	1,584	2,397	2,677	2,853	1,758	2,544	2,215	2,981	3,448
Landing	1,935	2,235	2,357	3,213	3,516	3,794	2,008	2,925	2,695	2,297	3,451	2,722
In warehouse	15,002	16,379	17,536	20,749	23,042	26,413	28,615	29,971	28,806	26,372	24,300	24,394
	29,032	33,581	32,972	36,595	39,771	42,611	41,950	43,805	40,150	39,676	40,811	42,498
By countries—												
United Kingdom—												
Afloat—												
Straits	1,415	1,800	605	988	1,499	890	845	285	220	170	375	370
Australia	55	80	85	35	30	15	5	------	------	30	55	50
Netherland East Indies	260	229	124	130	207	202	150	46	------	21	167	--
Stocks—All others	13,856	14,988	16,327	18,275	19,791	22,479	23,837	25,363	25,178	23,846	22,379	22,423
	15,586	17,097	17,141	19,428	21,527	23,586	24,837	25,694	25,398	24,067	22,976	22,843
United States of America—												
Afloat	6,925	9,072	8,593	7,453	7,131	6,181	7,551	6,752	6,161	7,280	8,805	8,234
Stocks and landings	3,081	3,626	3,566	5,687	6,767	7,728	6,786	7,533	6,323	4,823	5,372	4,693
	10,006	12,698	12,159	13,140	13,898	13,909	14,337	14,285	12,484	12,103	14,177	12,927
Continental Europe—												
Afloat—												
Straits	2,576	3,119	3,120	2,995	3,704	3,727	2,026	2,659	1,483	2,499	2,355	1,965
Netherland East Indies	864	667	552	1,032	642	1,389	750	828	484	774	1,016	4,424
Others	------	------	------	------	------	------	------	339	301	233	287	339
	3,440	3,786	3,672	4,027	4,346	5,116	2,776	3,826	2,268	3,506	3,658	6,728
Total visible supply	29,032	33,581	32,972	36,595	39,771	42,611	41,950	43,805	40,150	39,676	40,811	42,498

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[2] Calculated metallic tin content of ore and concentrates to the United Kingdom only (arrivals).

Tin shipped into the United States and nationality of bottoms in which shipped, 1929 and 1930, in long tons[1]

Country	Flag	1929	1930
Australia	United States (U. S. Shipping Board)	44	
	United States (Independent)	155	40
	British	402	151
		601	191
Canada:			
Atlantic	United States (Independent	16	
Pacific	do	70	
		86	
Ceylon	British		25
China	United States (U. S. Shipping Board)	25	188
	United States (Independent)	2,210	1,082
	British	1,321	474
	Japanese	1,979	2,075
	Norwegian		76
	Panamanian		105
		5,535	4,000
Egypt	British		25
	Netherland		400
			425
England	United States (U. S. Shipping Board)	89	75
	United States (Independent)	20	510
	British	16,380	11,756
		16,489	12,341
Germany	German	1,721	971
	Japanese	36	
		1,757	971
India	United States (Independent)	204	
Japan	Japanese	125	555
Java	United States (Independent)		10
	British	161	128
	Netherland	37	33
	Norwegian	26	
		224	171
Netherlands	United States (U. S. Shipping Board)		25
	Netherland	7,852	7,410
		7,852	7,435
Straits Settlements	United States (Independent)	29,243	22,909
	British	23,553	29,081
	Netherland	2,916	4,718
	Norwegian	372	135
		56,084	56,843
Sumatra	British	50	
Wales	Netherland	29	
Summary	United States (U. S. Shipping Board)	158	288
	United States (Independent)	31,918	24,551
	British	41,867	41,640
	German	1,721	971
	Japanese	2,140	2,630
	Netherland	10,834	12,561
	Norwegian	398	211
	Panamanian		105
		89,036	82,957

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[1] Division of Statistics, Bureau of Research, U. S. Shipping Board, Special Reports B. R. 1596, June 3, 1930, and B. R. 1976, Sept. 16, 1931. Figures subject to revision.

REVIEW BY COUNTRIES

BRITISH MALAYA

The southern part of the Malay Peninsula, which is known as British Malaya, consists of three major political divisions—the Federated Malay States, the Straits Settlements, and the Unfederated Malay States. The Federated Malay States is the world's leading producer of tin ore; the Straits Settlements holds first place in smelter output of tin; and the Unfederated Malay States (taken together) ranked ninth among the tin-ore producers of the world in 1930.

Federated Malay States.—The Federated Malay States produced concentrates containing 62,065 long tons of metallic tin in 1930, compared with 67,042 tons in 1929 and 61,935 tons in 1928. The output for 1930 was greater than that for any preceding year except 1929. Reduction in production was almost entirely the result of measures taken to curtail output in compliance with the program of the Tin Producers' Association. The ratio of production from European-owned mines to that from Chinese-owned mines remained virtually the same as in 1929. Moreover, the proportions of total output from dredges, from other placer mines, and from lode mines did not vary appreciably from those of 1929. The lack of change in the importance of the various sources of tin production clearly demonstrates the static condition into which the tin-mining industry has fallen. Nevertheless, during this period of apparent stagnation there has been a most active campaign to reduce expenses by every possible means. As a result many companies, whose costs in former years were well above the tin prices of 1930, have continued to operate.

Summary of Federated Malay States mining-method statistics, 1926–1930[1]

	1926		1927		1928		1929		1930	
	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total	Long tons	Per cent of total
Production:										
European-owned mines	20,216	44	21,234	41	30,348	49	41,565	62	39,083	63
Chinese-owned mines	25,731	56	30,945	59	31,587	51	25,476	38	22,982	37
	45,947	100	52,179	100	61,935	100	67,041	100	62,065	100
Dredges	9,143	20	12,501	24	18,752	30	25,950	39	23,617	38
Other placer mines	33,634	73	36,998	71	39,777	65	38,213	57	34,946	56
Lode mines	3,170	7	2,680	5	3,406	5	2,878	4	2,772	5
Combined methods									730	1
	45,947	100	52,179	100	61,935	100	67,041	100	62,065	100

NUMBER OF DREDGES AT END OF YEAR

In use or working	50	70	89	105	99
Under construction	21	21	21	10	11
On order or proposed	41	23	9	8	2
Temporarily idle					38

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[1] Based on data presented in Federated Malay States Report on the Administration of the Mines Department and on the Mining Industries, Kuala Lumpur, Annual, except figures for 1930, which were compiled from Federated Malay States Monthly Bulletin of Statistics.

During 1930, 502 mines were closed down, but 451 mines were either opened or reopened. The net reduction in the horsepower of mining machinery in use was 17,064. Much more serious was the net reduction of working forces by 8,976 coolies. No serious labor trouble has been reported, however.

The voluntary curtailment plans of the Tin Producers' Association proved a topic for constant discussion in the Federated Malay States. Many plans were proposed, but no plan received universal support. Toward the close of 1930 many companies announced that their production for that year would be so regulated that it would equal 80 per cent of that for 1929. This action, however, could not have been very widely applied, as the 1930 production was more than 92 per cent of that for 1929.

During the closing months of the year a movement was started to control production by legislation and on an international basis. Negotiations finally effected an agreement between the Federated Malay States, Bolivia, the Netherland East Indies, and Nigeria. The plan was based on a series of quotas. The four Governments agreed on their respective quotas and then proceeded to allocate their national quotas to their many tin producers. The whole quota system was supported by legislation that made production in excess of the quota subject to severe penalties. This plan for curtailment finally got under way on March 1, 1931, but the adjustment of individual quotas will require several months.

Some resentment is reported among the Federated Malay States producers because their curtailment is much greater than that for the Netherland East Indies. Moreover, there still remains some sentiment for a "no-curtailment-survival-of-the-fittest" treatment of the tin problem. Nevertheless, the quota system has been adopted, and it will probably be continued with minor changes until the end of its 2-year term.

Straits Settlements.—From the standpoint of mine production this British Crown colony has never been an important factor in the world's supply of tin ore, but in smelter production it leads the world. The needs of its large smelting industry are supplied by imports of tin concentrates from other parts of the Malay Peninsula and from the East Indies. Practically all the metallic tin produced is exported, and in consequence a record of such exports approximates the smelter production of the country. The following table shows the exports of tin from the Straits Settlements and the countries to which they were consigned.

Tin exported from British Malaya, 1928–1930, by destinations, in long tons

Destination	1928	1929	1930	Destination	1928	1929	1930
British possessions	5,311	4,998	4,929	United States	56,984	57,695	57,869
Countries of Europe	19,769	20,622	22,160	Other countries	1,679	1,272	1,092
Japan	2,401	2,045	1,556				
United Kingdom	12,908	15,392	9,398		99,052	102,024	97,004

There are two great tin-smelting centers in this colony. The larger is at Pulau Brani, Singapore, headquarters of the Straits Trading Co. (Ltd.); the smaller, at Penang, where the Consolidated

Tin Smelters (Ltd.) operates the smelter of the Eastern Smelting Co. (Ltd.). Consolidated Tin Smelters (Ltd.) was formed on December 28, 1929, and its board is composed of five directors representing British interests and five representing Bolivian interests, with Simon I. Patiño as chairman. Thus, the Patiño group made its first major acquisition in the tin business of the Far East.

The export duty on tin concentrates from the British-controlled sections of the Malay Peninsula to countries outside the British Empire affords these companies a virtual monopoly on Malayan tin smelting. In addition to the tin concentrates from British Malaya they treat large quantities of ore imported from the Netherland East Indies, Siam, and Burma.

Unfederated Malay States.—The Unfederated Malay States—Johore, Kedah, Perlis, Kelantan, and Trengganu—are distinct States governed by their several native rulers, but all are under the protection and control of the British Empire. These States produced tin concentrates containing 1,910 long tons of metallic tin in 1930, compared with 2,326 tons in 1929 and 2,680 tons in 1928. Johore and Trengganu are the principal producers, but each of the other States makes some contribution to the total tin output.

BOLIVIA

In 1930 Bolivia continued to be the world's second largest producer and exporter of tin and the leading producer of lode tin. The production of tin in 1930 was 38,161 long tons, compared with 46,343 tons in 1929 and 41,409 tons in 1928. In spite of the 18 per cent decrease in the 1930 production, from that in 1929, the 1930 output exceeded that in any year prior to 1928. The product from the mines—concentrates containing about 60 per cent of tin and known in the trade by the native name "barilla"—was all exported for treatment abroad. Most of it was shipped to the United Kingdom. The following table shows the exports of tin in concentrates from Bolivia in 1929 and 1930, by months.

Tin contained in concentrates exported from Bolivia, 1929 and 1930, by months, and average grade of concentrates exported [1]

Month	1929		1930		Month	1929		1930	
	Long tons	Grade of concentrates (per cent of tin)	Long tons	Grade of concentrates (per cent of tin)		Long tons	Grade of concentrates (per cent of tin)	Long tons	Grade of concentrates (per cent of tin)
January	3,692	56.14	3,687	53.53	August	3,471	55.51	2,554	57.16
February	3,079	55.81	3,305	54.56	September	3,676	54.42	3,714	56.69
March	4,129	54.80	3,175	54.34	October	4,172	54.86	3,261	56.49
April	4,350	56.05	3,326	55.60	November	3,418	54.19	2,848	58.92
May	3,959	54.21	3,389	55.40	December	4,290	55.68	3,026	59.20
June	3,832	55.89	2,452	55.40					
July	4,269	55.70	3,424	58.14		[2] 46,337	55.27	38,161	56.17

[1] Compiled from monthly figures furnished by U. S. Bureau of Foreign and Domestic Commerce.

[2] A slight adjustment was made in this total at the end of the year. For adjusted total see world table on p. 372.

The tin production is derived almost exclusively from lode deposits. These deposits, situated in the Andes Mountains, probably were more nearly inaccessible at the time of their discovery than any other known mineral deposits of their size in the world. The magnitude of present operations has resulted in remarkable development of rail transportation and hydroelectric power; one railroad reaches the highest point ever reached by rail in crossing the Andes from the coast to the area where the principal tin deposits are situated. There are many tin mines in Bolivia, but the difficulty of providing power and transportation has favored consolidation of their ownership in the hands of relatively few companies. Of these companies the Patiño Mines & Enterprises Consolidated (Inc.) is by far the largest and is, in fact, the largest tin-producing company in the world.

The Patiño Mines & Enterprises Consolidated (Inc.), a company incorporated under the laws of Delaware, is the result of a consolidation of many of Simon I. Patiño's tin-mining and allied interests in Bolivia. The company's properties are in the vicinity of Llallagua, Province of Bustillo, Department of Potosi. The production from its mines accounted for almost half of the tin contained in the concentrates exported from Bolivia. The following table has been compiled from data contained in the company's annual report.

Mining and milling results of the Patiño Mines & Enterprises Consolidated (Inc.), 1928–1930

Year	Ore mined [1]		Ore milled			Concentrates produced for export		Cost per pound of tin produced			Ore reserves (Dec. 31)	
									Marketed at London			
	Metric tons	Grade (per cent of tin)	Metric tons	Grade (per cent of tin)	Recovery (per cent)	Metric tons	Grade (per cent of tin)	Total operating	Exclusive of depreciation	Inclusive of depreciation	Metric tons (dry)	Grade (per cent of tin)
1928	711,627	3.34	481,028	4.64	77.06	26,708	64.46	$0.188	$0.290	$0.340	1,605,637	4.45
1929	986,620	3.05	703,592	3.94	76.23	33,333	63.33	.199	.294	.336	1,964,864	4.20
1930	787,678	3.06	565,607	3.96	77.56	27,330	63.51	.183	.257	.309	1,876,473	4.11

[1] Does not include a very small production of shipping ore.

The importance of the welfare of this company to the Government of Bolivia is indicated in the following quotation from the company's annual report:

> The enterprise (Patiño Mines & Enterprises Consolidated, Inc.), because of its magnitude, is of paramount importance to Bolivia. Perhaps a sixth of the revenue of the Republic comes directly or indirectly from the corporation and, furthermore, between 20,000 and 30,000 people depend on the corporation for a livelihood. Consequently the Bolivian Government requires to be consulted before measures calculated to adequately reduce operating costs may be given effect.

It is reported that many of the smaller tin-mining companies are being closed down by the fall in the tin price. So important, however, is the production of tin in the national economy of Bolivia that the Government will undoubtedly do everything in its power to relieve taxation and promote the industry.

NETHERLAND EAST INDIES

The principal tin-producing areas of the Netherland East Indies are on the small islands of Banka, Billiton, and Singkep. This chain of islands is geologically a continuation of the range of mountains that forms the backbone of the Malay Peninsula and along the sides of which the tin deposits of the peninsula occur.

The production of tin in the Netherland East Indies was 34,590 long tons in 1930, compared with 35,236 tons in 1929 and 35,660 tons in 1928. In 1924 the tin output of the Netherland East Indies passed 30,000 tons, and its annual production has not fallen below this level since that year. The Dutch have argued that overproduction of tin has resulted from the rapid expansion of tin production in countries other than the Netherland East Indies. For this reason they refused to curtail production but agreed not to increase production. Overproduction finally grew so bad, however, that the Netherland East Indies joined the quota plan but on a basis that reduced its output considerably less than that of the other three participants. In connection with fixing the responsibility for overproduction, the producers of British Malaya have pointed out that it is the Dutch who have so greatly increased their output since 1910.

The following table gives the production of the Netherland East Indies from 1926 to 1930.

Tin content of tin ores produced in the Netherland East Indies, 1926–1930, in long tons

District	Operator	1926	1927	1928	1929	1930
Banka [1]	Government	19, 851	21, 535	21, 483	21, 118	21, 597
Billiton [1]	Billiton Co	11, 322	11, 869	12, 981	12, 720	11, 588
Singkep Island [1]	Singkep Tin Co	1, 000	955	990	1, 099	1, 174
Singkep Sea dredging [1]						
Sumatra	Stannum Co	61	128	173	218	98
Riouw Archipelago				33	81	133
		32, 234	34, 487	35, 660	35, 236	34, 590

[1] Figures are for various fiscal years, as follows: Banka, Mar. 1 to Feb. 28; Billiton, June 1 to May 31; Singkep, July 1 to June 30.

There are, and have been for many years, but three large operators in the Netherland East Indies—the Dutch Government, the Billiton Co., and the Singkep Tin Co.

The Government areas are on the island of Banka and supply approximately 60 per cent of the total production of the country. The tin is mined largely from alluvial deposits worked by open-pit methods, but dredges are now being introduced. Most of the work is done by Chinese coolies either under contract or under the direct supervision of Government agents.

The Billiton Co. has held a tin-mining concession on the island of Billiton since 1852 and is the only important producer on the island. The company obtains the larger part of its production from alluvial deposits. Unlike the government areas of Banka, however, there is an important production from tin-bearing lodes on Billiton. The company pays the Government a royalty of five-eighths of the profits made in alluvial mining.

The Singkep Tin Co. operates under a concession granted in 1899. This company operates alluvial and lode mines on Singkep Island and also recovers some tin by dredging the sea bottom near the island.

The tin concentrates of the Netherland East Indies are smelted partly within the country and partly in the Straits Settlements.

NIGERIA

Nigeria produced tin concentrates containing 8,696 long tons of tin in 1930, compared with 10,742 tons in 1929 and 9,132 tons in 1928; all the concentrates were exported for smelting. The output for 1930, however, exceeded that for any year prior to 1928. Most of the production was derived from the alluvial deposits of the Bauchi Plateau in the northeastern part of the country, several hundred miles from the Atlantic coast.

The British Colony and Protectorate of Nigeria has been undergoing rapid development, but the falling price of tin has arrested the plans for increasing the rate of exploitation of the tin deposits for the present. The Government has suspended most of the regulations that were designed to force the rapid development of tin-bearing areas held by prospecting organizations. The current price of tin, however, would have proved far more serious to the Nigerian tin-mining industry had it not been for the lower costs resulting from the improved transportation and power facilities made available in recent years.

From the standpoint of world production the companies of Nigeria are for the most part very small. The one outstanding producer of tin concentrates is the Associated Tin Co., a subsidiary of the Anglo-Oriental Mining Corporation (Ltd.). The Associated Tin Co., in consolidating smaller companies, has brought under its control the mines that furnish the bulk of its present production, but it has also been active in developing properties on its own account. Added to these operations has been its development of central power stations to serve the mining industry of Nigeria.

The 1930 output of tin was 81 per cent of that in 1929, thus indicating that the program of the Tin Producers' Association to reduce production 20 per cent was virtually carried out in Nigeria. Further curtailment, however, may be expected in 1931, as Nigeria has joined the Federated Malay States, Bolivia, and the Netherland East Indies in the quota plan for tin-production curtailment.

SIAM

Siam continued to increase its tin output and produced 11,060 long tons in 1930, compared with 10,517 tons in 1929 and 7,572 tons in 1928. The tin deposits are in the part of Siam that occupies a portion of the Malay Peninsula; they are found on both sides of the mountain range that forms the backbone of the peninsula. At present the most productive areas are on the western side of the range and include among others the Puket Island and Tongkah Harbor districts. It is interesting to note that the proportion produced by dredging operations has increased at the same time that the price of tin has fallen. Except for concentrates treated by a few native smelters supplying local markets, all the concentrates are shipped to the great smelting centers of the Straits Settlements for treatment.

Some of the companies operating in Siam were members of the Tin Producers' Association, but their curtailment of output was not enough to offset increases from other sources. Siam has developed its tin resources rapidly during the last few years, and some of the newer mines did not reach the productive stage until 1930. Moreover, a study of the reserves [8] of tin ore throughout the world in 1928 brought out the fact that Siam had more nonproductive tin reserves in proportion to its production than any other important tin-producing country. It is reported [9] that the Siamese Government will not consider applications for new mining leases or prospecting licenses until further notice, except under special conditions.

The countries that have adopted the quota plan for regulating tin output attempted to persuade the Government of Siam to join the plan. Siam, however, rejected the plan when the quotas were being assigned to the other members. In July the Government changed its attitude and joined the quota scheme effective September 1, 1931. The initial quota is reported to be 10,000 long tons a year. This tonnage will require less curtailment of output by Siamese producers than the quotas of any of the other countries will require of their respective tin producers.

CHINA

The shipments from China in 1930 were reported as 6,483 long tons of tin, compared with 6,778 tons in 1929 and 7,033 tons in 1928. Virtually the entire output of China comes from the area extending from the Kotchiu district near Mengtze in the southeastern part of Yunnan into the adjacent Provinces of Kwangtung and Kwangsi and into northern Indo-China. In fact, approximately 95 per cent of China's tin production is mined in the Kotchiu district alone, according to Marshall D. Draper.[10] Draper's article was reprinted [11] in the Mining Journal (London).

The following items are based on Draper's article. Various records indicate that mining began as early as 1400 A. D. and that one mine, which now has a probable depth of 3,000 feet, was opened more than 500 years ago. It is said that lead and silver were the principal metals in the surface ores but that tin minerals increased rapidly to the exclusion of the others at depth.

The system of leasing and subleasing results in very complicated claims to ownership of ore bodies. The opening of an ore body usually follows the granting of mining rights to the original lessee, who then begins operations on some outcrop. His lease gives him the right to follow the ore body, including all its connected offshoots. If the main ore body proves large enough for the lessee he then subleases promising side stringers to others. They, too, may sublease to others. Many disputes arise from this system because the ore bodies are connected by a very complicated network of veins and stringers; several lessees or sublessees may discover the same ore body by following different stringers.

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[8] Merrill, Charles White, World Reserves and Resources of Tin: Inf. Circ. 6249, Bureau of Mines, 1930, 8 pp.

[9] Siamese Tin Regulation: Metals (Monthly supplement to Daily Metal Reporter), No. 4, October, 1930, p. 33.

[10] Draper, Marshall D., Tin Industry of Yunnan, China: Min. and Met., vol. 12, No. 292, April, 1931, pp. 178–186, and concluded in the following issue.

[11] Mining Journal (London), The Tin Industry of Yunnan: Vol. 173, No. 4996, May 23, 1931, p. 415, and subsequent issues to and including that of June 27, 1931.

The ore occurs in limestone that has been fractured by the intrusion of a granite batholith. The granite apparently furnished the tin minerals which were carried into the overlying limestone by ascending solutions. The placers of the area could be called more properly residual deposits as they occur in sink holes in the limestone. Water, except as a lime solvent, seems to have played no part in the concentration. These so-called placers are virtually exhausted.

Primitive mining, concentrating, and smelting methods continue in use but are being displaced gradually by modern equipment and methods. Progress is slow, however, because of the lack of a local supply of fuel for power generation and metallurgical use. Smelting is still accomplished with charcoal.

UNITED KINGDOM

The production of tin (content of domestic ores) in the United Kingdom was 2,488 long tons in 1930, compared with 3,271 tons in 1929 and 2,761 tons in 1928. Virtually the entire output came from Cornwall, a century ago the leading tin-producing region of the world. The production comes largely from mines with long histories, some dating back to the Roman period. The revival of mining in this region, begun during the period of high tin price, has again relapsed because of the falling price of tin. Apparently these famous mines must await a period of higher prices before they can be operated profitably.

The importance of the United Kingdom in tin production is not based upon the ore output of the mines of Cornwall, but rather upon the tin output of the smelters of Liverpool in Lancaster and Redruth in Cornwall. The combined capacity of these smelting plants is approximately 72,000 tons of tin per year, or 40 per cent of the world's annual smelter output. The formation of Consolidated Tin Smelters (Ltd.) placed virtually all the tin smelting in the United Kingdom under one management. This has effected important economies as well as strengthened the British position in the tin-smelting business. Tin smelting in the British Isles is made profitable largely because that country is the natural meeting point of cheap fuel, expert smeltermen, Bolivian concentrates, and Nigerian concentrates. Mixing the two types of concentrates effects smelting economies by diluting the impurities present in the Bolivian product. The consolidation of the smelter of the Patiño group (Williams, Harvey), which controls much of the Bolivian output, with the smelter of the Anglo-Oriental group (Penpoll), which controls much of the Nigerian output, has made possible the most efficient mixed smelter charges. The Penpoll smelter has been closed temporarily as a result of the consolidation and of lower demand.

OTHER COUNTRIES

The countries separately discussed accounted for an output of approximately 165,000 long tons, or 95 per cent of the 1930 world total. India and Australia furnished nearly one-half of the remaining 9,000 tons. Production in 1930 in India increased a little over that in 1929, but there were sharp decreases in production in Australia, the Union of South Africa, and Belgian Congo. Production in Indo-China and Japan continued near the 1929 level.

The activity in prospecting and development, which in the last few years has marked potential tin-producing areas, apparently has been largely suspended because of the obvious overproduction of tin at present. Nevertheless, this work had already interested the tin industry in the future production possibilities of Belgian Congo, Indo-China, and several other countries that have produced little tin so far. When tin consumption again overtakes production, interest undoubtedly will revive in the possibilities of Tanganyika, Uganda, South-West Africa, Swaziland, Gold Coast, French Morocco, Portuguese East Africa, Rhodesia, Spain, Portugal, Russia, Japan. Argentina, Mexico, and Canada.

WORLD'S TIN SMELTERS

The smelting of tin is very centralized, both from the standpoint of location and from the standpoint of control. The nationality of control closely parallels the nationality of tin-ore production. The smaller consumption of 1930 has not furnished enough smelting business to permit any of the tin smelters to operate at capacity. Furthermore, some of the plants probably are obsolescing rapidly during this period of curtailed production. The following table contains the latest comparative data on the world's tin smelters.

Name, location, control, and capacity of the world's tin smelters in 1929

Smelter	Location	Control	Capacity (long tons) [1]
Straits Trading Co. (Ltd.)	Singapore and Butterworth, Straits Settlements.	British	65,000
Williams, Harvey & Co. (Ltd.)	Liverpool, England	British-Bolivian [2]	45,000
Eastern Smelting Co. (Ltd.)	Penang, Straits Settlements		25,000
Cornish Tin Smelting Co. (Ltd.)	Redruth, Cornwall		15,000
Penpoll Tin Smelting Co. (Ltd.)	Liverpool, England		12,000
	Netherland East Indies	Dutch	25,000
Arnhem	Arnhem, Netherlands	do	[3] 1,500
		German and others	8,000

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[1] Annual production of pig tin as reported in Mining Magazine (London), vol. 39, August, 1928, p. 86.

[2] Control the result of formation of Consolidated Tin Smelters (Ltd.), which is equally controlled by British and Bolivian interests.

[3] Approximate tin content of ores purchased during 1929.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA[1]

(MINE REPORT)

By T. H. MILLER[2]

CONTENTS

	Page
Summary	385
Mining industry	392
Ore classification	393
Metallurgic industry	399
Review by counties and districts	405
Beaverhead County	405
Broadwater County	406
Cascade County	408
Deerlodge County	409
Fergus County	410
Flathead County	410
Granite County	410
Jefferson County	412
Judith Basin County	413
Lewis and Clark County	414
Review by counties and districts—Continued.	
Lincoln County	417
Madison County	418
Meagher County	421
Mineral County	421
Missoula County	422
Park County	422
Phillips County	423
Powell County	423
Ravalli County	424
Sanders County	424
Silver Bow County	42
Butte or Summit Valley district	425
Stillwater County	429

SUMMARY

The output of gold, silver, copper, lead, and zinc from Montana mines in 1930 was valued at $32,720,416, a decrease of $39,059,131 (more than 54 per cent) from that in 1929 and a decrease of 35 per cent from the yearly average of $50,372,358 for the decade 1921 to 1930. Accurate production records for Montana have been kept since 1904. The record output during the period 1904 to 1930 was established in 1916 ($133,882,947), and the smallest output was in 1921 ($16,324,521); the value of the output in 1930 was less than that of any other year except 1921. There were large decreases in the production of all metals, particularly copper, which decreased over 101,000,000 pounds, and zinc, which decreased over 83,000,000 pounds. The sharp decline in the prices of silver, copper, lead, and zinc resulted in marked curtailment of production at all of the leading base-metal properties. In 1930 Montana ranked second in the production of copper, after Arizona; third in silver, after Utah and Idaho; and eighth in zinc, after Oklahoma, New Jersey, Kansas, Utah, Idaho, Colorado, and New Mexico.

The total value of the gold, silver, copper, lead, and zinc produced from mines in Montana from 1862 to 1930 is estimated at $2,774,599,732. An exact summary of the value of the metal output of Montana by years has never been compiled, but an estimate of $1,099,019,699 was given by the Director of the Mint[3] for the gold, silver, copper, and lead produced from 1862 to 1903.

The total value of the mine production of gold, silver, copper, lead, and zinc in Montana from 1904 to 1930, as recorded in Mineral Resources of the United States, has been $1,675,580,033. Details of production are as follows: Ore, old tailings, etc., 134,163,338 short tons; gold, $76,808,835; silver, 332,163,474 fine ounces; copper, 6,800,313,869 pounds; lead, 550,632,864 pounds; and zinc, 2,677,342,376 pounds.

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[1] Work on manuscript completed October, 1931.

[2] The valuable assistance of Paul Luff and Jeannette Froiseth, of the Bureau of Mines, is acknowledged.

[3] Director of the Mint, Ann. Rept. for 1904, p. 93.

Silver Bow County, which includes the Butte or Summit Valley district, continued to produce most of the silver, copper, and zinc, and in 1930 the county produced nearly 24 per cent of the lead and nearly 30 per cent of the gold. The value of the output of the county amounted to more than 89 per cent of the total value of the metal output of the State.

Published reports show that the Anaconda Copper Mining Co. was the only mining company in Montana that paid dividends in 1930. The company paid $44,219,676, but part of the Anaconda dividend was paid from receipts from operations in other States. Dividend 110, declared by the Anaconda Copper Mining Co. late in 1930, was not actually paid until February 16, 1931, and will be credited to the year 1931. No complete record of the dividends paid by mining companies in Montana has ever been kept, but if the dividends of the last six years are added to an estimate made by one of the mining journals[4] a total of $452,471,204 to the end of 1930 is obtained. The Anaconda, Amalgamated, North Butte, Butte & Superior, and Parrot companies have paid the larger part of this total.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

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[4] Mining Truth, May 16, 1925, p. 93.

Mine production of gold, silver, copper, lead, and zinc in Montana, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	348	97	1, 324, 801	71, 631. 91	$1, 480, 763	6, 558, 713	$6, 558, 713
1922	315	78	4, 385, 878	80, 145. 62	1, 656, 757	12, 468, 151	12, 468, 151
1923	304	78	5, 743, 535	85, 079. 43	1, 758, 748	13, 380, 862	10, 972, 307
1924	302	86	4, 652, 482	97, 854. 16	2, 022, 825	13, 289, 303	8, 903, 833
1925	331	93	4, 405, 008	82, 122. 85	1, 697, 630	13, 158, 191	9, 131, 784
1926	335	58	4, 470, 055	60, 504. 11	1, 250, 731	12, 769, 092	7, 967, 913
1927	247	60	4, 222, 607	53, 541. 25	1, 106, 796	11, 200, 077	6, 350, 444
1928	236	43	4, 344, 279	58, 196. 09	1, 203, 020	10, 853, 276	6, 349, 166
1929	212	40	4, 723, 445	54, 758. 03	1, 131, 949	12, 716, 977	6, 778, 149
1930	193	73	2, 686, 669	43, 489. 17	899, 001	7, 052, 889	2, 715, 362

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	48, 098, 730	$6, 204, 736	20, 366, 917	$916, 511	23, 275, 966	$1, 163, 798	$16, 324, 521
1922	165, 754, 442	22, 376, 850	29, 767, 479	1, 637, 211	119, 069, 818	6, 786, 980	44, 925, 949
1923	224, 125, 264	32, 946, 414	35, 945, 623	2, 516, 194	141, 460, 392	9, 619, 307	57, 812, 970
1924	249, 152, 062	32, 638, 920	39, 476, 008	3, 158, 081	128, 475, 218	8, 350, 889	55, 074, 548
1925	268, 910, 847	38, 185, 340	37, 530, 644	3, 265, 166	115, 316, 922	8, 764, 086	61, 044, 006
1926	255, 372, 862	35, 752, 201	42, 306, 193	3, 384, 495	147, 401, 507	11, 055, 113	59, 410, 453
1927	223, 492, 639	29, 277, 536	35, 898, 315	2, 261, 594	160, 461, 803	10, 269, 555	49, 265, 925
1928	248, 262, 027	35, 749, 732	33, 759, 644	1, 958, 059	165, 660, 189	10, 105, 272	55, 365, 249
1929	297, 725, 973	52, 399, 771	39, 213, 707	2, 470, 464	136, 351, 734	8, 999, 214	71, 779, 547
1930	196, 187, 523	25, 504, 378	21, 306, 044	1, 065, 302	52, 841, 108	2, 536, 373	32, 720, 416

Gold and silver produced at placer mines in Montana, 1921–1930

Year	Gold		Silver		Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value		Fine ounces	Value	Fine ounces	Value
1921	10, 988. 91	$227, 161	1, 591	$1, 591	1926	1, 104. 30	$22, 828	162	$101
1922	3, 472. 65	71, 786	652	652	1927	1, 079. 97	22, 325	197	112
1923	1, 972. 68	40, 779	360	295	1928	865. 14	17, 884	149	87
1924	1, 323. 59	27, 361	187	125	1929	596. 66	12, 334	71	38
1925	1, 905. 25	39, 385	405	281	1930	720. 74	14, 899	86	33

GOLD

The production of gold in Montana in 1930 was valued at $899,001, a decrease of more than 20 per cent from $1,131,949 in 1929 and more than 36.7 per cent below the average for the past 10 years. The output of gold in Montana has decreased steadily since the record production of $5,004,195 in 1915, and in 1930 it was less than that of any year since detailed records were started in 1904. For the past five years more than 50 per cent of the gold produced in Montana has come from copper ore, and the marked curtailment in the mining of this class of ore during 1930 resulted in a decrease of nearly 10,000 ounces in gold recovered from copper ore. Most of the large companies (chiefly the Anaconda Copper Mining Co.) operating at Butte reported large decreases in gold output. Large decreases were also reported by the New Gould Mining Co., operating northwest of Helena, and the St. Louis

Mining & Milling Co. near Marysville. These decreases were partly offset by the large increase in the gold output recovered at the Spring Hill property south of Helena in Lewis and Clark County and at the Liberty Montana mine near Jefferson Island in Madison County. Silver Bow County has for several years produced more than half the total gold from Montana. In 1930 the Silver Bow County gold output decreased nearly 50 per cent, and Lewis and Clark County became the leading producer. Madison County ranked third in gold output, and the three counties together accounted for nearly 90 per cent of the total. Amalgamation and cyanidation mills (nearly all amalgamation) produced 3 per cent of the total gold, yielding an average of $5.03 in gold and 12 cents in silver to the ton of ore, old tailings, etc., treated. Concentrates of all kinds yielded 86 per cent of the total gold, and crude ore shipped to smelters yielded 8 per cent. Dry and siliceous gold ore, old tailings, etc., yielded 40 per cent of the gold; copper ore, old tailings, etc., 50 per cent; lead ore and slag, 2 per cent; lead-zinc ore, 5 per cent; zinc ore and slag and copper-lead ore, 1 per cent; and placers, nearly 2 per cent. There was an unusually large decrease in gold from copper ore but a good increase from siliceous gold ore. Decreases were also shown in gold from zinc ore and lead-zinc ore.

Three properties produced more than 79 per cent of the total gold from Montana in 1930. The Spring Hill mine near Helena ranked first, followed by the Anaconda group at Butte and the Liberty Montana property near Jefferson Island. The Spring Hill mine increased its output of gold 49 per cent and rose from second to first place as a producer of gold in Montana. Other large producers of gold were the Comet mine near Basin, Jefferson County; the August mine at Landusky, Phillips County; and the Block P property near Hughesville, Judith Basin County.

SILVER

The output of silver from mines in Montana in 1930 was 7,052,889 ounces, valued at $2,715,362, compared with 12,716,977 ounces, valued at $6,778,149, in 1929, a decrease of nearly 60 per cent in value. The 1930 output was about 38 per cent less than the yearly average of 11,344,753 ounces for the decade 1921 to 1930, and except for 1921 it was lower than for any year since detailed records were started in 1904.

There were decreases in the quantity of silver recovered from all classes of ore, and the decrease from copper ore, zinc ore, and lead-zinc ore from Silver Bow County accounted for 80 per cent of the total decrease. Sixty-five per cent of the total silver was obtained from copper ore, old tailings, etc., nearly 18 per cent from lead-zinc ore, 9 per cent from siliceous silver ore and old tailings, and more than 6 per cent from zinc ore and slag. Silver Bow County, chiefly the Butte district, produced nearly 75 per cent of the total silver; most of the remainder came from three mines in Judith Basin, Flathead, and Granite Counties. Concentrates yielded 79 per cent of the silver and first-class smelting ore 20 per cent; most of the remainder came from old tailings smelted.

Six properties produced more than 89 per cent of the total silver from Montana in 1930; each of these yielded more than 225,000 ounces and three of them—the copper mines of the Anaconda Copper Mining Co., the Block P property, and the Flathead mine—more than 500,000 ounces each. The Anaconda Copper Mining Co. produced more than half of the State's output of silver in 1930. The other three large producers were the Butte & Superior, Trout, and East Butte properties.

COPPER

The production of copper from mines in Montana in 1930 was 196,187,523 pounds, valued at $25,504,378, compared with 297,725,973 pounds, valued at $52,399,771, in 1929, a decrease of more than 101,000,000 pounds (34 per cent) in quantity and 51 per cent in value. The output was 10 per cent less than the average annual output of 217,708,237 pounds for the decade 1921 to 1930. The average sale price of copper declined from 17.6 cents a pound in 1929 to 13 cents a pound in 1930, and the trade journals reported sales of copper at less than 10 cents a pound at the close of the year.

As a result of the low price obtainable during 1930 the larger copper producers operated under the rigid curtailment program adopted during the latter part of 1929. The resulting copper production was less than that of any year since 1922. The output of gold and silver derived from copper ore was similarly affected. Except for 715,582 pounds of copper, chiefly from Judith Basin, Madison, Granite, and Jefferson Counties, the total output of copper came from Silver Bow County, which includes the Butte district. Copper ore, old tailings, etc., yielded 99.55 per cent of the total copper. Concentrates yielded more than 90 per cent of the copper and crude ore of all kinds shipped to smelters 3 per cent; the remainder (nearly 7 per cent) of the copper was saved chiefly from precipitates and old tailings smelted. The sulphide copper ore of smelting grade yielded 6,151,980 pounds of copper, an average of 4.86 per cent, and the oxidized copper ore 51,126 pounds, an average of 10.83 per cent. Slag resmelted, old tailings and pond slimes smelted, and copper precipitates from mine waters yielded 12,552,427 pounds of copper.

Three properties in Montana each produced more than 4,000,000 pounds of copper in 1930. The mines of the Anaconda Copper Mining Co., including various old tailings dumps and slime ponds, yielded nearly 95 per cent of the State's output; the other two properties were the North Butte and East Butte. Other large producers of copper were the Butte & Superior, Block P, and Liberty Montana mines.

LEAD

The production of lead in Montana in 1930 decreased nearly 46 per cent in quantity from that in 1929. The output of lead from Silver Bow County, which accounted for 42 per cent of the production in 1929, decreased more than 11,000,000 pounds in 1930 and amounted to about 24 per cent of the State total. This unusually large decrease from Silver Bow County was due to the curtailment in the mining of lead-zinc ore and zinc ore at the mines at Butte. A large decrease in lead output was also reported from Judith Basin and Broadwater Counties, but a substantial increase was recorded from Sanders County due to the mining of lead ore by the Jack Waite Mining Co.

Lead-zinc ore yielded 66 per cent (63 per cent in 1929) of the lead, lead ore and slag nearly 20 per cent, zinc ore and slag 13 per cent, and copper-lead ore nearly 1 per cent. Concentrates yielded 86 per cent of the total output of lead, crude ore of all kinds shipped to smelters 8 per cent, and slag 6 per cent. The greater part of the lead from Montana mines, saved at East Helena, arrives at the smelter in residues from the electrolytic zinc plants at Anaconda and Great Falls or in lead concentrates from the mills at Anaconda and Butte.

Four properties—the Block P (St. Joseph Lead Co.), Emma, Jack Waite, and Butte & Superior, each yielding more than 1,500,000 pounds—produced more than 77 per cent of the total lead. Other large producers were the Comet and Trout properties near Basin. Some lead as well as much zinc was recovered from slag treated in the fuming plant at East Helena.

ZINC

The production of zinc in Montana in 1930 was 52,841,108 pounds, valued at $2,536,373, compared with 136,351,734 pounds, valued at $8,999,214, in 1929, a decrease of 61 per cent in quantity and 72 per cent in value. The output was nearly 56 per cent less than the yearly average of 119,031,466 pounds for the decade 1921 to 1930, and it was the smallest annual output since 1921. The average sale price of zinc declined from 6.6 cents a pound in 1929 to 4.8 cents a pound in 1930. Curtailment of operations by all the large producers of zinc and the apparent exhaustion of commercial ore reserves at one of the leading properties at Butte resulted in an unprecedented decline in the zinc output. A decrease of more than 73,000,000 pounds of zinc was recorded from the mines at Butte in Silver Bow County. There were also large decreases in zinc from mines in Granite, Jefferson, and Judith Basin Counties and from slag re-treated at East Helena in Lewis and Clark County. The mines at Butte, Silver Bow County, produced nearly 53 per cent (74 per cent in 1929) of the total zinc from Montana in 1930; most of the remainder came from the slag plant at East Helena, Lewis and Clark County, and from mines in Judith Basin, Granite, and Jefferson Counties. The electrolytic zinc plants at Great Falls and Anaconda were not operated at full capacity but continued to treat custom zinc products from various States and produced slab zinc at an average rate of about 310 tons a day, exclusive of the zinc recovered from dross and residue. The Timber Butte custom mill at Butte was operated most of the year on a part-time basis, and the custom milling plant at Anaconda was closed in October. The Butte & Superior Mining Co., which shipped its entire zinc product to Anaconda for milling, and the East Helena slag plant together produced approximately 60 per cent of the zinc of the State and the Emma and Block P properties about 29 per cent. Zinc ore and slag yielded 60 per cent of the zinc, and lead-zinc ore nearly all of the remainder. The largest producers of zinc in Montana in 1930 were the Butte & Superior property at Butte, the slag plant at East Helena, the Emma mine at Butte, the Block P (St. Joseph Lead Co.) property near Hughesville, and the Trout mine near Philipsburg. These four properties, exclusive of the slag product, produced nearly 70 per cent of the total zinc output of the State.

The following tables show the relative importance of Silver Bow County or the Butte district. Judith Basin and Lewis and Clark Counties were the only other counties in Montana that produced metals valued at more than $1,000,000 in 1930.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1930, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Beaverhead	57.86	$1,196	8.95	$185	$1,381	9,018	$3,472
Broadwater	615.67	12,727	111.55	2,306	15,033	9,413	3,624
Cascade	7.79	161	-----	-----	161	8,920	3,434
Deerlodge	192.48	3,979	-----	-----	3,979	149	57
Fergus	4.55	94	9.38	194	288	20	8
Flathead	16.98	351	-----	-----	351	596,344	229,592
Granite	547.31	11,314	58.44	1,208	12,522	371,325	142,960
Jefferson	1,032.13	21,336	15.67	324	21,660	101,475	39,068
Judith Basin	562.12	11,620	-----	-----	11,620	603,317	232,277
Lewis and Clark	14,065.32	290,756	41.31	854	291,610	16,939	6,522
Lincoln	171.97	3,555	12.48	258	3,813	8,386	3,229
Madison	11,660.40	241,042	187.51	3,876	244,918	50,557	19,464
Meagher	-----	-----	2.51	52	52	-----	-----
Mineral	3.87	80	71.84	1,485	1,565	4,590	1,767
Missoula	7.11	147	72.03	1,489	1,636	1,138	438
Park	-----	-----	26.27	543	543	397	153
Phillips	686.01	14,181	-----	-----	14,181	214	82
Powell	114.36	2,364	97.04	2,006	4,370	2,074	799
Ravalli	-----	-----	5.76	119	119	-----	-----
Sanders	48.91	1,011	-----	-----	1,011	11,042	4,251
Silver Bow	12,973.59	268,188	-----	-----	268,188	5,257,545	2,024,155
Stillwater	-----	-----	-----	-----	-----	26	10
	42,768.43	884,102	720.74	14,899	899,001	7,052,889	2,715,362
Total, 1929	54,161.37	1,119,615	596.66	12,334	1,131,949	12,716,977	6,778,149

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	6,081	$791	93,884	$4,694	-----	-----	$10,338
Broadwater	2,317	301	284,978	14,249	1,974	$95	33,302
Cascade	19,090	2,482	147,255	7,363	4,022	193	13,633
Deerlodge	203	26	-----	-----	-----	-----	4,062
Fergus	-----	-----	-----	-----	-----	-----	296
Flathead	-----	-----	45,310	2,265	-----	-----	232,208
Granite	134,195	17,445	630,346	31,517	3,320,510	159,385	363,829
Jefferson	87,573	11,384	1,062,973	53,149	967,213	46,426	171,687
Judith Basin	247,274	32,146	9,155,321	457,766	6,454,404	309,811	1,043,620
Lewis and Clark	21,798	2,834	1,457,180	72,859	13,896,250	667,020	1,040,845
Lincoln	157	20	80,249	4,012	-----	-----	11,074
Madison	166,153	21,600	596,982	29,849	19,038	914	316,745
Meagher	-----	-----	-----	-----	-----	-----	52
Mineral	330	43	65,198	3,260	124,591	5,980	12,615
Missoula	8,444	1,098	5,317	266	-----	-----	3,438
Park	-----	-----	654	33	-----	-----	729
Phillips	-----	-----	-----	-----	-----	-----	14,263
Powell	677	88	26,816	1,341	-----	-----	6,598
Ravalli	-----	-----	-----	-----	-----	-----	119
Sanders	17,832	2,318	2,573,360	128,668	85,134	4,086	140,334
Silver Bow	195,471,941	25,411,352	5,080,221	254,011	27,967,972	1,342,463	29,300,169
Stillwater	3,458	450	-----	-----	-----	-----	460
	196,187,523	25,504,378	21,306,044	1,065,302	52,841,108	2,536,373	32,720,416
Total, 1929	297,725,973	52,399,771	39,213,707	2,470,464	136,351,734	8,999,214	71,779,547

Ore, old tailings, etc., sold or treated, lode mines producing, and average value of ore, etc., in gold and silver in Montana, 1929 and 1930, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Beaverhead	4,593	257	8	5	$6.34	$18.16
Broadwater	6,541	828	18	28	6.16	19.74
Cascade	48,746	355	5	1	1.76	10.13
Deerlodge	588	275	5	6	19.96	14.68
Fergus	----------	1	------	1	----------	102.00
Flathead	10,273	9,712	2	1	46.03	23.68
Granite	57,440	19,986	12	9	5.59	7.72
Jefferson	22,136	11,137	31	20	6.06	5.42
Judith Basin	106,751	82,552	5	3	4.05	2.95
Lewis and Clark	153,125	155,323	26	22	1.84	1.91
Lincoln	1,613	1,864	4	1	2.43	3.64
Madison	39,325	37,864	41	52	6.14	6.88
Meagher	27	----------	2	------	.11	----------
Mineral	449	360	2	2	8.00	5.13
Missoula	13	94	3	2	9.15	6.21
Park	415	2	2	1	19.46	75.50
Phillips	11	44	2	4	110.36	324.16
Powell	121	106	10	10	23.19	29.80
Ravalli	65	----------	1	------	17.15	----------
Sanders	----------	14,051	------	3	----------	.37
Silver Bow	4,271,213	2,351,836	33	18	1.36	.97
Stillwater	----------	22	------	1	----------	.45
	4,723,445	2,686,669	212	193	1.67	1.34

Gold and silver produced at placer mines in Montana in 1930, by counties

County	Mines		Gold	Silver (fine ounces)	Total value
	Drift	Hydraulic and sluicing			
Beaverhead	------	2	$185	------	$185
Broadwater	------	6	2,306	19	2,313
Fergus	------	1	194	------	194
Granite	1	6	1,208	10	1,212
Jefferson	------	2	324	------	324
Lewis and Clark	3	5	854	5	856
Lincoln	------	4	258	------	258
Madison	3	6	3,876	34	3,889
Meagher	------	1	52	------	52
Mineral	1	8	1,485	------	1,485
Missoula	------	8	1,489	2	1,490
Park	------	4	543	6	545
Powell	1	10	2,006	10	2,010
Ravalli	------	1	119	------	119
	9	64	14,899	86	14,932
Total, 1929	5	35	12,334	71	12,372

MINING INDUSTRY

The mining industry in Montana in 1930 was confronted with the problem of disposing of its products in a declining metal market where stocks of unsold metal were rapidly accumulating. The average sale prices of copper, lead, zinc, and silver in 1930 were much lower than those of the preceding year. These abnormal marketing conditions led to drastic curtailment measures, particularly at the large copper and zinc mines. As a result of the curtailment the value of the output from Silver Bow County was seriously affected and declined more than $36,000,000 from the value in 1929. The metal output of the

State fell to a level comparable with that of 1921, when the copper industry was virtually at a standstill. There was a decrease of more than 101,000,000 pounds in the output of copper and of more than 83,000,000 pounds in the output of zinc, chiefly from mines at Butte. A larger decrease in the output of gold was prevented by a marked increase in the production from the Spring Hill mine at Helena.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Montana, 1921–1930, with content in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
DRY AND SILICEOUS ORE						
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	164, 906	47, 377. 95	1, 546, 910	85, 468	956, 655	
1922	373, 311	53, 343. 24	2, 197, 802	217, 906	581, 205	
1923	342, 253	54, 743. 81	1, 280, 235	50, 271	42, 867	
1924	207, 487	63, 174. 26	947, 083	309, 015	627, 015	
1925	194, 691	38, 081. 43	591, 369	157, 745	368, 128	
1926	93, 571	23, 810. 07	345, 456	55, 266	72, 924	
1927	111, 976	18, 389. 30	427, 105	22, 865	93, 674	
1928	112, 331	18, 492. 10	340, 876	13, 723	44, 673	
1929	102, 268	16, 974. 00	1, 198, 531	50, 844	3, 436	
1930	95, 548	17, 752. 33	657, 439	18, 396	3, 591	
COPPER ORE						
1921	928, 461	4, 733. 30	1, 663, 472	[1] 46, 888, 812	1, 029	
1922	3, 250, 213	13, 367. 13	5, 446, 684	[1] 162, 860, 743		
1923	4, 420, 601	19, 776. 67	7, 619, 864	[1] 220, 471, 500	1, 864	
1924	3, 437, 931	24, 926. 12	7, 845, 180	[1] 243, 927, 687		
1925	3, 190, 841	32, 352. 64	8, 656, 401	[1] 265, 201, 209		
1926	3, 179, 051	27, 289. 67	7, 762, 190	[1] 250, 247, 871		
1927	2, 958, 445	27, 241. 47	6, 201, 827	[1] 218, 647, 748	1, 630	
1928	3, 174, 509	33, 546. 34	5, 705, 513	[1] 244, 708, 989		
1929	3, 802, 976	31, 030. 94	7, 289, 007	[1] 294, 697, 579		
1930	2, 238, 997	21, 715. 70	4, 583, 827	[1] 195, 308, 188		
LEAD ORE						
1921	113, 481	4, 151. 98	1, 352, 125	215, 114	7, 414, 293	11, 167
1922	96, 203	2, 783. 02	647, 754	33, 275	8, 133, 697	
1923	105, 450	2, 368. 15	437, 703	184, 842	8, 741, 531	69, 560
1924	78, 656	1, 486. 37	287, 041	222, 066	7, 829, 188	
1925	118, 062	2, 393. 79	532, 219	387, 701	9, 320, 422	
1926	132, 039	2, 391. 32	514, 628	363, 825	8, 467, 354	
1927	57, 182	1, 540. 90	314, 100	196, 402	4, 912, 945	
1928	10, 419	574. 72	178, 520	14, 989	3, 005, 336	
1929	15, 436	785. 51	163, 300	80, 441	4, 927, 763	
1930	23, 642	788. 58	91, 635	48, 742	4, 198, 956	85, 134
COPPER-LEAD ORE						
1921	334	10. 59	26, 244	24, 388	166, 526	
1922	21, 251	659. 18	122, 153	204, 497	518, 697	
1923	106, 325	271. 05	340, 559	598, 152	1, 445, 059	
1924	160, 883	332. 74	573, 038	1, 181, 998	2, 339, 877	
1925	195, 327	2, 113. 50	555, 365	1, 382, 541	2, 576, 816	
1926	224, 322	331. 43	668, 986	1, 650, 177	3, 910, 331	
1927	263, 868	314. 92	559, 918	1, 573, 206	2, 812, 096	
1928	192, 839	284. 61	402, 705	804, 791	2, 490, 272	
1929	48, 059	83. 20	144, 382	401, 578	972, 896	
1930	330	7. 80	8, 860	19, 000	142, 600	

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[1] Includes copper recovered from precipitates.

Ore, old tailings, etc., sold or treated in Montana, 1921–1930, with content in terms of recovered metals—Continued

ZINC ORE, LEAD-ZINC ORE, AND COPPER-LEAD-ZINC ORE

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	117,619	4,369.18	1,968,371	884,948	11,828,414	23,264,799
1922	644,900	6,520.46	4,053,106	2,438,021	20,533,880	119,069,818
1923	768,906	5,947.07	3,702,141	2,820,499	25,714,302	141,390,852
1924	767,525	6,611.68	3,636,774	3,511,296	28,679,928	128,475,218
1925	706,087	5,276.24	2,822,432	1,781,651	25,265,278	115,316,922
1926	841,072	5,577.32	3,477,670	3,055,723	29,855,584	147,401,507
1927	831,136	4,974.69	3,696,930	3,052,418	28,077,970	160,461,803
1928	854,181	4,433.18	4,225,513	2,719,535	28,219,363	165,660,189
1929	754,706	5,287.72	3,921,686	2,495,531	33,309,612	136,351,734
1930	328,152	2,504.02	1,711,042	793,197	16,960,897	52,755,974

Ore, old tailings, etc., sold or treated in Montana in 1930, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	106	[1] 78,376	17,396.01	10,967	13,302	3,361	
Dry gold and silver ore	2	371	90.00	6,047	142		
Dry silver ore	10	[2] 16,801	266.32	640,425	4,952	230	
Copper ore	18	[3] 2,238,997	21,715.70	4,583,827	[4] 195,308,188		
Lead ore	50	[5] 23,642	788.58	91,635	48,742	4,198,956	85,134
Zinc ore	2	[6] 159,288	349.96	449,183	259,482	2,814,213	31,811,856
Copper-lead ore	1	330	7.80	8,860	19,000	142,600	
Lead-zinc ore	20	168,864	2,154.06	1,261,859	533,715	14,146,684	20,944,118
Total, lode mines	[7] 193	2,686,669	42,768.43	7,052,803	[4] 196,187,523	21,306,044	52,841,108
Total, placers	73		720.74	86			
	266	2,686,669	43,489.17	7,052,889	[4] 196,187,523	21,306,044	52,841,108
Total, 1929	252	4,723,445	54,758.03	12,716,977	[8] 297,725,973	39,213,707	136,351,734

[1] Includes 550 tons of old tailings cyanided, 3 tons of old slag amalgamated, and 3 tons of old slag sold to a smelter.

[2] Includes 7,000 tons of old tailings concentrated.

[3] Includes 27,421 tons of old tailings and 2,315 tons of pond slimes sold to a smelter.

[4] Includes 11,465,232 pounds of copper recovered from precipitates.

[5] Includes 1,651 tons of old slag sold to a smelter.

[6] Includes 80,000 tons of current slag fumed.

[7] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[8] Includes 6,464,032 pounds of copper (corrected figure) recovered from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Montana in 1930, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	78,376	$359,608	$4,222	$1,729	$168		$365,727
Dry gold and silver ore	371	1,861	2,328	19			4,208
Dry silver ore	16,801	5,505	246,564	644	11		252,724
Copper ore	2,238,997	448,903	1,764,773	[1] 25,390,064			27,603,740
Lead ore	23,642	16,301	35,280	6,336	209,948	$4,086	271,951
Zinc ore	159,288	7,234	172,935	33,733	140,711	1,526,969	1,881,582
Copper-lead ore	330	161	3,411	2,470	7,130		13,172
Lead-zinc ore	168,864	44,529	485,816	69,383	707,334	1,005,318	2,312,380
	2,686,669	884,102	2,715,329	[1] 25,504,378	1,065,302	2,536,373	32,705,484
Total, 1929	4,723,445	1,119,615	6,778,111	[2] 52,399,771	2,470,464	8,999,214	71,767,175

[1] Includes value of 11,465,232 pounds of copper recovered from precipitates.

[2] Includes value of 6,464,032 pounds of copper (corrected figure) recovered from precipitates.

GOLD ORE

Gold ore, old tailings, etc., largely dry and siliceous, were reported from 106 mines and dumps in Montana in 1930, compared with 69 in 1929. This material, the output of which increased 36 per cent, yielded on the average $4.59 in gold and 0.14 ounce of silver to the ton and a little copper and lead and was valued at $4.67 in recovered metals a ton. Lewis and Clark County produced most of the gold ore; the Spring Hill mine, near Helena, Lewis and Clark County, increased its output of gold ore 76 per cent and produced 90 per cent of the total gold ore, with the Boss Tweed property near Pony and the Emma B. (Smuggler Mining Co.) mine near Sheridan, in Madison County, following. The Porphyry Dike mine near Rimini and the New Gould property northwest of Marysville, large producers of gold ore in 1929, were idle in 1930, and the output from the Drumlummon mine at Marysville decreased considerably.

GOLD AND SILVER ORE

Gold and silver ore was reported from one mine in Granite County and one in Jefferson County in 1930. This ore yielded on the average $5.02 in gold and 16.30 ounces of silver to the ton and a little copper. Most of the output was milling ore from the Hoffman property at Maxville, Granite County.

SILVER ORE

A total of 10 mines produced the output of siliceous silver ore and old tailings in Montana in 1930, which yielded on the average 33 cents in gold and 38.12 ounces of silver to the ton and a little copper and lead and was valued at $15.04 in recovered metals a ton. The output of this class of material was less than half that in 1929, as a result of the notable decrease in the treatment of old silver tailings from the Granite Bimetallic dump at Philipsburg, Granite County. More than 98 per cent of the total output was silver ore from the Flathead mine near Kila and old silver tailings from the Granite Bimetallic dump.

COPPER ORE

Copper ore, old tailings, etc., the output of which decreased more than 1,500,000 tons compared with 1929, were reported from 18 mines and dumps in Montana in 1930 and represented more than 83 per cent of the total output of ore, etc., of the State. The average yield of ore, etc., was 20 cents in gold and 2.05 ounces of silver to the ton, and 4.11 per cent (82 pounds to the ton) of copper, exclusive of copper recovered from precipitates; the average value in recovered metals a ton was $11.66, exclusive of the value of copper from precipitates. Nearly all the copper ore was mined at Butte—largely from the Anaconda, North Butte, and East Butte properties— and most of it was milling ore. The Liberty Montana Mines Co., operating the Mammoth property near Jefferson Island, Madison County, was also a large producer of copper ore.

LEAD ORE

The output of lead ore and old slag, reported from 49 mines and 1 slag dump in Montana in 1930, increased from 15,436 tons in 1929 to 23,642 tons in 1930. The increase in lead ore in 1930 was due entirely to the mining of lead ore in the eastern extension of the Jack Waite mine near the divide between Shoshone County, Idaho, and Sanders County, Mont. The Jack Waite property produced more than half the total lead ore. About 7 per cent of the lead material was old slag from the East Helena dump, Lewis and Clark County; no slag was shipped from the Hecla dump near Melrose, Beaverhead County, in 1930. The average yield of the ore and slag in 1930 was 69 cents in gold and 3.88 ounces of silver to the ton, 0.10 per cent of copper, 8.88 per cent of lead, and 0.18 per cent of zinc; the average value in recovered metals was $11.50 a ton. Other large producers of lead ore were the Hazel T. mine near Libby, the East Helena slag dump near Helena, the Empire (Metalsmith Mines Corporation) group near Marysville, and the Buckeye mine near Sheridan. The Joe Dandy mine near Radersburg was the largest producer of lead ore in Montana in 1929, but its production in 1930 was unimportant.

ZINC ORE

The zinc material from two mines and one slag fuming plant represented 6 per cent of the total output of ore, etc., of the State and consisted of sulphide zinc ore concentrated and of slag re-treated to volatilize the zinc. The material decreased from 430,971 tons in 1929 to 159,288 tons in 1930, due chiefly to the greatly reduced output from the property of the Butte & Superior Mining Co. The average yield of the ore and slag was 5 cents in gold and 2.82 ounces of silver to the ton, 0.08 per cent of copper, 0.88 per cent of lead, and 9.99 per cent of zinc; the average value in recovered metals a ton was $11.81. About half the zinc material came from the property of the Butte & Superior Mining Co.; nearly all the remainder was current slag from the East Helena lead smelter, treated in a special plant by the Anaconda Copper Mining Co. The output of zinc ore from the property of the Butte & Superior Mining Co. was only about one-third that in 1929; there were also large decreases in the output of zinc ore from the properties of the Anaconda Copper Mining Co. and the North Butte Mining Co.

COPPER-LEAD ORE

A small quantity of copper-lead ore of smelting grade was produced by lessees from the Silver Dyke property at Neihart. The property was a large producer of copper-lead ore from 1923 to 1929, but no work on company account was done in 1930.

LEAD-ZINC ORE

The output of lead-zinc ore in Montana in 1930 was reported from 20 mines and represented 6 per cent of the total output of ore, etc., of the State; the quantity was only about half that in 1929, as the output from the mines at Butte decreased decidedly. There were also large decreases in the output of lead-zinc ore from mines in Judith Basin, Granite, and Jefferson Counties. The average yield was 26 cents in gold and 7.47 ounces of silver to the ton, 0.16 per cent of copper, 4.19 per cent of lead, and 6.20 per cent of zinc. The average value in recovered metals a ton was $13.69. Two mines, one at Butte, Silver Bow County, and the other near Hughesville, Judith Basin County, produced nearly 75 per cent of the lead-zinc ore. The largest producers were the Block P, Emma, Trout, Comet, and Anaconda properties.

Ore, old tailings, etc., sold or treated in Montana in 1930, by counties, with content in terms of recovered metals

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
DRY GOLD ORE						
Broadwater	436	540.43	418	1,493	659	
Deerlodge	273	192.48	32	203		
Fergus	1	4.50	20			
Granite	3	5.80				
Jefferson	283	85.33	292	126		
Lewis and Clark	[1] 72,128	13,881.35	6,285	7,165	130	
Lincoln	163	21.10	8			
Madison	[2] 4,630	1,827.11	2,432	2,601	2,315	
Mineral	1	2.75				
Phillips	44	686.00	214			
Powell	67	97.07	424	447	107	
Sanders	50	5.00	50	60	150	
Silver Bow	297	47.09	792	1,207		
	78,376	17,396.01	10,967	13,302	3,361	
Total, 1929	57,676	14,549.72	29,748	2,919	3,263	
DRY GOLD AND SILVER ORE						
Granite	340	79.00	5,669			
Jefferson	31	11.00	378	142		
	371	90.00	6,047	142		
Total, 1929	847	540.78	17,678	8,712		
DRY SILVER ORE						
Deerlodge	2		117			
Flathead	9,551	17.00	586,539			
Granite	[3] 7,049	151.00	39,762	4,234		
Jefferson	2	4.62	558	17	115	
Lincoln	1		2,611		115	
Madison	68	28.00	3,799	581		
Sanders	1		324			
Silver Bow	127	65.70	6,715	120		
	16,801	266.32	640,425	4,952	230	
Total, 1929	43,745	1,883.50	1,151,105	39,213	173	
COPPER ORE						
Beaverhead	2	0.04	9	765		
Granite	249	10.86	1,288	53,268		
Jefferson	272	70.00	2,110	15,474		
Lewis and Clark	18		70	3,900		
Madison	30,005	9,634.80	16,710	153,205		
Missoula	86	7.00	1,091	8,444		
Silver Bow	[4] 2,208,343	11,993.00	4,562,523	[5] 195,069,674		
Stillwater	22		26	3,458		
	2,238,997	21,715.70	4,583,827	[5] 195,308,188		
Total, 1929	3,802,976	31,030.94	7,289,007	[6] 294,697,579		

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[1] Includes 550 tons of old tailings cyanided and 3 tons of old slag sold to a smelter.
[2] Includes 3 tons of old slag amalgamated.
[3] Includes 7,000 tons of old tailings concentrated.
[4] Includes 27,421 tons of old tailings and 2,315 tons of pond slimes sold to a smelter.
[5] Includes 11,465,232 pounds of copper recovered from precipitates.
[6] Includes 6,464,032 pounds of copper (corrected figure) recovered from precipitates.

Ore, old tailings, etc., sold or treated in Montana in 1930, by counties, with content in terms of recovered metals—Continued

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaverhead	255	57. 83	9, 009	5, 316	93, 884	
Broadwater	387	75. 23	8, 943	824	283, 796	
Flathead	161		9, 805		45, 310	
Granite	1	1. 30	6	6	190	
Jefferson	868	91. 40	11, 850	6, 222	175, 849	
Judith Basin	112	3. 69	3, 055	112	90, 688	
Lewis and Clark	[7] 3, 177	184. 00	4, 565	10, 733	263, 900	
Lincoln	1, 700	150. 89	5, 767	157	80, 134	
Madison	2, 929	159. 10	25, 877	7, 370	559, 019	
Missoula	8	. 10	45		5, 317	
Park	2		391		654	
Powell	39	17. 30	1, 640	230	26, 709	
Sanders	14, 000	43. 91	10, 668	17, 772	2, 573, 210	85, 134
Silver Bow	3	3. 83	14		296	
	23, 642	788. 58	91, 635	48, 742	4, 198, 956	85, 134
Total, 1929	15, 436	785. 51	163, 300	80, 441	4, 927, 763	

LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Broadwater	5		33		523	1, 974
Cascade	25		60	90	4, 655	4, 022
Granite	12, 344	299. 38	324, 590	76, 687	630, 156	3, 320, 510
Jefferson	9, 681	769. 76	86, 287	65, 592	887, 009	967, 213
Judith Basin	82, 440	558. 41	600, 262	247, 162	9, 064, 633	6, 454, 404
Madison	232	11. 37	1, 705	2, 396	35, 648	19, 038
Mineral	359	1. 13	4, 590	330	65, 198	124, 591
Silver Bow	63, 778	514. 01	244, 332	141, 458	3, 458, 862	10, 052, 366
	168, 864	2, 154. 06	1, 261, 859	533, 715	14, 146, 684	20, 944, 118
Total, 1929	320, 069	3, 925. 08	2, 327, 493	1, 041, 271	24, 709, 487	44, 879, 451

[7] Includes 1,651 tons of old slag sold to a smelter.

Zinc products (as marketed from Montana mines and mills) sold to smelters and electrolytic plants in 1930

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Zinc concentrates	Broadwater, Granite, Judith Basin, Sanders, and Silver Bow.	37, 318	40, 994, 146	54. 93	37, 533, 530
Lead-zinc concentrates.	Cascade, Jefferson, Madison, Mineral, and Silver Bow.	1, 483	1, 551, 887	52. 32	1, 411, 328
		38, 801	[1] 42, 546, 033	54. 83	[1] 38, 944, 858
Total, 1929		114, 024	[1] 129, 312, 450	56. 70	[1] 117, 364, 807

[1] Exclusive of zinc recovered from the treatment of current slag at East Helena.

METALLURGIC INDUSTRY

New construction work at concentration mills in Montana in 1930 included the enlargement of several old plants and the erection of a few new mills of limited capacity. The capacity of the Spring Hill mill of the Montana Mines Corporation was increased to about 350 tons a day by the addition of new grinding and classification machinery. New equipment was installed at the flotation plant of the Glacier Silver-Lead Mining Co. near Libby, raising its capacity from 100 to about 325 tons a day. The mill at the Keating mine of the Montana Exploration Co. was also rebuilt and enlarged. New 100-ton flotation mills were built by the Metalsmith Mines Corporation in Lewis and Clark County and the Liberty Metals Co. in Lincoln County. A new 100-ton gravity concentrator was built by the Princess Gold Mining Co., operating property near Thompson Falls, Sanders County. The large copper concentrator of the Anaconda Copper Mining Co. at Anaconda was operated the entire year, but three flotation plants, treating lead-zinc ore at Anaconda, Butte, and Hughesville, were closed late in the year. The large mill at the Silver Dyke mine near Neihart has been idle since early in 1929. The Jardine Mining Co. successfully treated tungsten ore by gravity concentration and marketed rich tungsten concentrates. The Anaconda Copper Mining Co. made a large-scale selective flotation test on manganese-zinc ore containing chiefly rhodochrosite and sphalerite. The following table lists the important mills active in 1930.

Mills in Montana active in 1930

Name of company	Location of mill	Method of treatment	Rated capacity of mill (short tons per day)	Ore and old tailings treated	Concentrates produced
Anaconda Copper Mining Co.:					
Copper concentrator	Anaconda	Flotation	12,000	Copper	Copper.
Zinc concentrator	do	do	1,750	Lead-zinc and zinc.	Lead, lead-zinc, and zinc.
Timber Butte	Butte	do	1,000	Copper-lead-zinc, lead-zinc, and zinc.	Lead, copper-lead-zinc, lead-zinc, and zinc.
Butte-Madison Mines Corporation.	Twin Bridges	Gravity	90	Lead	Lead.
Glacier Silver-Lead Mining Co.	Libby	Flotation	325	do	Do.
Granite Bimetallic Consolidated Mines Co.	Philipsburg	do	200	Siliceous silver	Siliceous silver.
Keating Gold Mining Co.	Radersburg	Gravity	50	Siliceous gold	Siliceous gold.
Liberty Montana Mines Co.	Jefferson Island.	Flotation	150	Copper	Copper.
Maxville Gold & Silver Mining & Development Co.	Maxville	do	100	Siliceous gold and silver.	Siliceous gold and silver.
Metalsmith Mines Corporation.	Helena	do	100	Lead	Lead.
Montana Mines Corporation.	do	do	350	Siliceous gold	Siliceous gold.
St. Joseph Lead Co	Hughesville	do	400	Lead-zinc	Lead and zinc.
Vigilantes Mining Corporation.	Sheridan	Gravity and flotation.	75	Lead	Lead.

Thirty-five milling plants of various kinds were active in Montana in 1930, although many of them ran for short periods only. They include 16 plants using the amalgamation process, 2 using amalgamation and concentration, 1 using cyanidation, 2 using table concentration, 3 using flotation equipment after table concentration, and 11 using straight flotation. There were also 2 electrolytic zinc-leaching plants, 1 copper-precipitating plant at Butte that recovers copper from mine waters, and 1 zinc fuming plant.

Of the ore, etc., treated at gold and silver mills, 4,854 tons (4,851 tons of ore and 3 tons of old slag) were treated by amalgamation, with an average recovery per ton of $5.36 in gold and 0.13 ounce of silver, and 80 tons of ore and 550 tons of old tailings were treated by cyanidation, with an average recovery per ton of $2.48 in gold and 1.73 ounces of silver. During the year about 780 pounds of quicksilver were used—0.16 pound per ton of ore amalgamated and 0.42 pound per ounce of gold and silver bullion recovered—and about 1,400 pounds of cyanide were used in gold and silver mills—1.203 pounds per ounce of gold and silver bullion and 2.222 pounds per ton of ore and old tailings treated. The quantity of ore and old tailings treated by these processes in 1930 was only about one-fourth of that in 1929, as the ore from the Spring Hill mine, part of which was treated by cyanidation in 1929, was all treated by flotation in 1930 and as the output of gold ore from the Drumlummon property decreased considerably. The Porphyry Dike mine near Rimini and the New Gould property near Marysville, large producers of gold ore treated by amalgamation in 1929, were idle in 1930. The quantity of gold recovered by cyanidation decreased from 2,991.32 ounces in 1929 to 75.70 ounces in 1930 and that recovered by amalgamation from 1,628.81 to 1,259.73 ounces.

Concentrating mills in Montana handled nearly 93 per cent of the total material mined or treated. The resulting concentrates, together with those from gold and silver mills, averaged $59.12 in recovered metals a ton compared with $85.40 in 1929, and the quantity of concentrates produced was 37 per cent less than in 1929. Both copper concentrates and zinc concentrates decreased considerably. The copper concentrates exceeded all others combined in total value of metals recovered; zinc concentrates ranked second.

In 1930, as in 1929, exact figures for the metal content of the mill feed were obtained from concentration mills treating Montana ore. These figures are presented in the accompanying tables and are separated by classes of ores treated, methods of concentration, and classes of concentrates produced. The metallurgic recoveries obtained by the use of flotation are also given. Of the total ore concentrated 99.9 per cent was treated by straight flotation, and less than 0.1 per cent by combined gravity and flotation and gravity methods without flotation equipment. These figures leave no doubt as to the importance of flotation in the concentration of Montana ores. The average assay content of the ore treated can be calculated from the following tables.

Mine production of metals from gold and silver mills in Montana in 1930, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated (dry weight)		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Broadwater	20		248.53	67		
Fergus	1		4.50	20		
Jefferson	160		16.33	6		
Lewis and Clark	573	[1] 550	208.92	173	75.70	1,088
Lincoln	162		15.70	7		
Madison	3,993	[1] 3	724.14	331		
Mineral	1		2.75			
Phillips	1		2.50	1		
Powell	19		34.27	12		
Silver Bow	1		2.09	2		
	4,931	553	1,259.73	619	75.70	1,088
Total, 1929	19,192	803	1,628.81	1,074	2,991.32	18,521

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Broadwater	5	37.70	136		659
Madison	122	399.60	370	206	
	127	437.30	506	206	659
Total, 1929	93	225.69	4,810		57

[1] Old slag.

Montana ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates

Class of material concentrated and method of concentration	Ore and old tailings concentrated	Gross content of mill feed				
		Gold	Silver	Copper	Lead	Zinc
Ore and old tailings by:						
Flotation—						
Siliceous gold, gold and silver, and silver	*Short tons* [1] 78,291	*Fine ounces* 20,888.80	*Fine ounces* 56,550	*Pounds* 18,800	*Pounds*	*Pounds*
Copper sulphide	2,145,706	26,644.58	4,062,482	192,930,355		
Lead sulphide	18,100	505.50	29,540	36,000	2,874,000	129,000
Lead-zinc sulphide	168,864	3,525.96	1,514,187	703,150	15,772,169	25,079,537
Zinc sulphide	79,288	653.00	522,508	347,629	1,939,946	21,020,856
Total by flotation	2,490,249	52,217.84	6,185,267	194,035,934	20,586,115	46,229,393
Gravity and flotation	[2] 1,364	30.00	2,500	10,000	40,000	
Gravity	[3] 508	112.60	2,135	1,900	57,600	
Total by all methods	[4] 2,492,121	52,360.44	6,189,902	194,047,834	20,683,715	46,229,393

[1] Includes 7,000 tons of siliceous silver old tailings.
[2] Lead sulphide ore.
[3] Includes 308 tons of siliceous gold ore and 200 tons of lead sulphide ore.
[4] Figures do not include 2,565 tons of siliceous gold ore first treated by amalgamation.

Montana ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates—Continued

Class of material concentrated and method of concentration	Concentrates produced		Gross content of concentrates				
	Class	Quantity	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings by flotation—							
Siliceous gold, gold and silver, and silver.	Siliceous gold, gold and silver, and silver.	[5] 4,787	13,435.47	44,705	12,110		
Copper sulphide	Copper sulphide	[6] 428,954	20,702.80	3,811,973	183,910,188		
Lead sulphide	Lead sulphide	2,252	396.20	24,635	30,954	2,566,713	(7)
	Zinc sulphide	108		255		17,000	96,743
Total from lead sulphide.		2,360	396.20	24,890	30,954	2,583,713	96,743
Lead-zinc sulphide	Copper-lead sulphide.	31	2.96	2,580	8,227	39,083	(7)
	Lead sulphide	10,566	943.05	676,333	263,430	13,080,158	(7)
	Lead-zinc sulphide.	1,483	550.39	68,122	58,542	418,616	1,551,887
	Zinc sulphide	19,702	697.40	537,114	274,898	1,317,218	21,309,859
Total from lead-zinc sulphide.		31,782	2,193.80	1,284,149	605,097	14,855,075	22,861,746
Zinc sulphide	Copper-lead sulphide.	932	128.68	188,227	103,889	1,194,938	(7)
	Zinc sulphide	17,508	225.79	260,144	196,371	518,628	19,587,544
Total from zinc sulphide.		18,440	354.47	448,371	300,260	1,713,566	19,587,544
Total by flotation		486,323	37,082.74	5,614,088	184,858,609	19,152,354	42,546,033
Gravity and flotation		[8] 124	20.73	1,624	5,051	32,417	
Gravity		[9] 141	78.94	1,629	1,522	40,335	
Total by all methods.		[10] 486,588	37,182.41	5,617,341	184,865,182	19,225,106	42,546,033

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[5] Includes siliceous silver concentrates from siliceous silver old tailings.

[6] Copper concentrates made at Anaconda are all classified as flotation product in spite of the fact that one section of the copper mill was at times used to make a table concentrate suitable for the manufacture of sulphuric acid or for fluxing purposes.

[7] Zinc content of material treated at most lead smelters is lost.

[8] Lead sulphide concentrate.

[9] Includes 94 tons of siliceous gold and 47 tons of lead sulphide concentrates.

[10] Figures do not include 127 tons of concentrates from ore treated at amalgamation-concentration plants, containing 437.30 ounces of gold, 506 ounces of silver, 240 pounds (206 pounds recovered) of copper, and 694 pounds (659 pounds recovered) of lead.

Metallurgic results obtained by flotation of Montana ore and by concentration of Montana ore and old tailings in 1930

Material treated	Concentrates produced	Ratio of concentration	Per cent recovered in concentrates				
			Gold	Silver	Copper	Lead	Zinc
Ore and old tailings by flotation:							
Siliceous gold, gold and silver, and silver.	Siliceous gold, gold and silver, and silver.	16.35 : 1	64.32	79.05	64.41		
Copper sulphide	Copper sulphide	5.00 : 1	77.70	93.83	95.32		
Lead sulphide	Lead sulphide	8.04 : 1	78.38	83.40	85.98	89.31	
	Zinc sulphide			.86		.59	75.00
Total lead sulphide		7.67 : 1	78.38	84.26	85.98	89.90	75.00
Lead-zinc sulphide	Copper-lead sulphide		.08	.17	1.17	.25	
	Lead sulphide	15.98 : 1	26.75	44.67	37.47	82.93	
	Lead-zinc sulphide	113.87 : 1	15.61	4.50	8.32	2.65	6.19
	Zinc sulphide	8.57 : 1	19.78	35.47	39.10	8.35	84.97
Total lead-zinc sulphide		5.31 : 1	62.22	84.81	86.06	94.18	91.16
Zinc sulphide	Copper-lead sulphide	85.07 : 1	19.71	36.02	29.88	61.60	
	Zinc sulphide	4.53 : 1	34.57	49.79	56.49	26.73	93.18
Total zinc sulphide		4.30 : 1	54.28	85.81	86.37	88.33	93.18
Total by flotation		5.12 : 1	71.02	90.77	95.27	93.04	92.03
Total by all methods		5.12 : 1	71.02	90.75	95.27	92.95	92.03

Mine production of metals from concentrating mills in Montana in 1930, by counties, in terms of recovered metals

County	Ore and old tailings treated (dry weight)		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Broadwater	263		89	70.00	84	1,241	523	1,974
Cascade	25		7		60	90	4,655	4,022
Granite	12,684	7,000	3,993	528.38	367,342	80,216	630,156	3,320,510
Jefferson	10,281		1,580	792.06	92,056	69,652	959,461	967,213
Judith Basin	82,440		14,657	558.41	600,262	247,162	9,064,633	6,454,404
Lewis and Clark	72,251		4,529	13,291.77	3,382	12,035	149,067	
Lincoln	1,700		117	150.89	5,767	157	80,134	
Madison	32,696		2,923	9,756.64	24,200	160,224	175,085	19,038
Mineral	359		158	1.13	4,590	330	65,198	124,591
Sanders	13,650		1,844	44.91	9,218	15,332	2,114,985	85,134
Silver Bow	2,258,772		456,691	11,943.97	4,482,883	176,804,913	5,079,925	27,967,972
	2,485,121	7,000	486,588	37,138.16	5,589,844	177,391,352	18,323,822	38,944,858
Total, 1929	4,405,035	35,729	771,299	43,806.80	11,212,298	279,397,376	32,882,470	117,364,807

Gross metal content of Montana concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	5, 008	13, 947. 77	45, 312	13, 737	854	------------
Copper	428, 954	20, 702. 80	3, 811, 973	183, 910, 188	------------	------------
Lead	12, 989	1, 363. 92	704, 120	299, 570	15, 719, 463	------------
Zinc	37, 318	923. 19	797, 513	471, 269	1, 852, 846	40, 994, 146
Copper-lead	963	131. 64	190, 807	112, 116	1, 234, 021	------------
Lead-zinc	1, 483	550. 39	68, 122	58, 542	418, 616	1, 551, 887
	486, 715	37, 619. 71	5, 617, 847	184, 865, 422	19, 225, 800	42, 546, 033
Total, 1929	771, 392	44, 032. 49	11, 217, 108	291, 392, 979	34, 613, 450	129, 312, 450

Mine production of metals from Montana concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Broadwater	94	107. 70	220	1, 241	1, 182	1, 974
Cascade	7	------------	60	90	4, 655	4, 022
Granite	3, 993	528. 38	367, 342	80, 216	630, 156	3, 320, 510
Jefferson	1, 580	792. 06	92, 056	69, 652	959, 461	967, 213
Judith Basin	14, 657	558. 41	600, 262	247, 162	9, 064, 633	6, 454, 404
Lewis and Clark	4, 529	13, 291. 77	3, 382	12, 035	149, 067	------------
Lincoln	117	150. 89	5, 767	157	80, 134	------------
Madison	3, 045	10, 156. 24	24, 570	160, 430	175, 085	19, 038
Mineral	158	1. 13	4, 590	330	65, 198	124, 591
Sanders	1, 844	44. 91	9, 218	15, 332	2, 114, 985	85, 134
Silver Bow	456, 691	11, 943. 97	4, 482, 883	176, 804, 913	5, 079, 925	27, 967, 972
	486, 715	37, 575. 46	5, 590, 350	177, 391, 558	18, 324, 481	38, 944, 858
Total, 1929	771, 392	44, 032. 49	11, 217, 108	279, 397, 376	32, 882, 527	117, 364, 807

BY CLASSES OF CONCENTRATES

Dry and siliceous	5, 008	13, 947. 77	45, 312	12, 049	809	------------
Copper	428, 954	20, 702. 80	3, 811, 973	176, 556, 845	------------	------------
Lead	12, 989	1, 363. 92	704, 120	252, 448	15, 012, 762	------------
Zinc	37, 318	899. 07	771, 728	432, 583	1, 748, 286	37, 533, 530
Copper-lead	963	131. 64	190, 807	86, 145	1, 172, 711	------------
Lead-zinc	1, 483	530. 26	66, 410	51, 488	389, 913	1, 411, 328

Crude ore directly smelted in 1930 amounted to only 3 per cent of the total ore mined or treated; the ore averaged $19.49 in recovered metals a ton. A decrease, especially in copper ore, of more than 39 per cent was recorded in the total quantity of crude ore smelted. Most of the first-class material was copper ore, and nearly all of it was from mines at Butte; it averaged $17.38 in recovered metals a ton.

Gross metal content of Montana crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	11,462	2,428.27	610,293	6,944	2,936
Copper	63,555	817.90	730,100	6,462,603	
Lead	2,327	367.71	60,896	22,297	1,624,631
Copper-lead	330	7.80	8,860	20,509	148,558
	77,674	3,621.68	1,410,149	6,512,353	1,776,125
Total, 1929	128,350	5,279.21	1,404,317	10,185,224	4,552,408

Mine production of metals from Montana crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Beaverhead	257	57.87	9,018	6,081	93,884
Broadwater	545	259.43	9,107	1,076	283,796
Cascade	330	7.80	8,860	19,000	142,600
Deerlodge	275	192.48	149	203	
Flathead	9,712	17.00	596,344		45,310
Granite	302	18.96	3,973	53,979	190
Jefferson	696	223.72	9,413	17,921	103,512
Judith Basin	112	3.69	3,055	112	90,688
Lewis and Clark	295	448.10	3,448	5,573	22,309
Lincoln	2	5.40	2,612		115
Madison	1,172	780.00	25,622	5,723	421,897
Missoula	94	7.10	1,136	8,444	5,317
Park	2		391		654
Phillips	43	683.50	213		
Powell	87	80.10	2,052	677	26,816
Sanders	401	4.00	1,824	2,500	458,375
Silver Bow	63,327	832.53	732,906	6,118,791	296
Stillwater	22		26	3,458	
	77,674	3,621.68	1,410,149	6,243,538	1,695,759
Total, 1929	128,350	5,279.21	1,404,317	9,740,852	4,324,035
BY CLASSES OF ORE					
Dry and siliceous	11,462	2,428.27	610,293	6,347	2,782
Copper	63,555	817.90	730,100	6,203,106	
Lead	2,327	367.71	60,896	15,085	1,550,377
Copper-lead	330	7.80	8,860	19,000	142,600

The miscellaneous material, other than old tailings milled and current slag from the lead smelter fumed at East Helena, consisted of 31,390 tons of old slag, old tailings, and pond slimes shipped for smelting. It came chiefly from Silver Bow County and yielded 235.86 ounces of gold, 44,583 ounces of silver, 1,087,195 pounds of copper, and 92,654 pounds of lead; in addition, precipitates from mine water supplied 11,465,232 pounds of copper.

REVIEW BY COUNTIES AND DISTRICTS

BEAVERHEAD COUNTY

The value of the production of metals in Beaverhead County decreased from $93,604 in 1929 to $10,338 in 1930, due chiefly to the lessened output of silver and lead from the Hecla mine east of Melrose and to the cessation of shipments of silver-lead slag from the Hecla dump.

Argenta district.—The production of the Argenta district was valued at $898 in 1930, a decrease from $1,772 in 1929 and from $23,546 in 1928. The output has been relatively unimportant since the closing of the Ferdinand mine near Argenta in 1929. The ore mined in 1930 consisted of a few tons of oxidized lead ore from the Iron Mountain and Brownell mines and a small lot of oxidized copper ore from the Goldsmith property, all near Argenta. Lessees operated the Goldsmith mine, owned by the Anaconda Cooper Mining Co., and reported development consisting of 85 feet of shaft sinking and 130 feet of drifting.

Bald Mountain district.—A little bullion was marketed from the Double Eagle placer near Bannack.

Bannack district.—No production was reported from the Bannack district in 1930. The I. B. Mining Co., operating the Sleeping Princess group of the New York-Montana Mines Co., completed a 20-mile electric transmission line from Dillon to the mine. The property is equipped with a 300-ton cyanidation plant.

Big Hole district.—A little placer gold was recovered from sluicing operations at the Little Nugget property.

Blue Wing district.—The New Departure property, from which lessees shipped several cars of silver ore in 1929, was idle in 1930.

Bryant district.—The value of the production from the Bryant district declined from $78,376 in 1929 to $7,501 in 1930. The Foundation Co. of Utah operated the Hecla property near Melrose under an option until November, 1930, when the property was returned to the original owners. The company did about 2,000 feet of development and shipped several cars of oxidized lead ore to Midvale, Utah. In 1930 no slag was shipped from the old Hecla dump, which was a large producer of lead and silver from 1923 to 1929.

Chinatown district.—Lessees continued to operate the Hamilton mine near Armstead and shipped two cars of sulphide lead ore to Midvale, Utah, for smelting. About 200 feet of development was reported.

Elkhorn district.—No production was reported from the Elkhorn group of the Boston-Montana Mines Co. near Coolidge, but the rehabilitation campaign started in 1929 was continued. About 400 feet of drifting and 30 feet of raising were reported at the mine in 1930. The repair work on the 45-mile narrow-gage railroad (Montana Southwestern Railroad Co.) from Coolidge to Divide was completed, and the 750-ton gravity and flotation concentrator, idle since 1925, was reconditioned. A large quantity of low-grade milling ore was said to have been blocked out, but milling operations were not resumed in 1930. The mine was formerly a large producer of copper-lead-silver ore.

Vipond district.—Development was continued at the Lone Pine-Argyle Silver group of the Quartz Hill Mining Co. About 200 feet of shaft sinking and 400 feet of drifting were reported in 1930.

BROADWATER COUNTY

The value of the production of metals in Broadwater County decreased from $202,681 in 1929 to $33,302 in 1930 as a result of the decided decrease in the shipments of lead ore from the Joe Dandy mine near Radersburg, one of the largest producers of lead in Montana in 1929. There was also a large decrease in the output of the Keating mine of the Montana Exploration Co., where new milling equipment was being installed at the close of the year.

Backer district (*Canton*).—Four placers and four lode mines in the Backer district produced 31 tons of ore, $7,780 in gold, 230 ounces of silver, and 659 pounds of lead, valued in all at $7,902. The ore yielded on the average $205.87 in metals a ton; the placer output was valued at $1,520. A small lot of siliceous gold ore was produced at the Blind Mike property in Johnies Gulch near Watson. Most of the ore was shipped for smelting, but a small test lot was treated by amalgamation and concentration at the Henry Miller custom mill near Diamond City. A small lot of unusually rich gold ore from the Slim Jim mine near Canton was also treated by amalgamation and concentration at the Miller mill. Bullion and concentrates containing more than 200 ounces of gold were marketed. The property was operated from April to September, and 100 feet of development was reported. A test lot of gold ore from the Osborne property was treated by amalgamation and concentration. Most of the placer output of the Backer district came from the Consolidated Placer (Eldorado Bar) in Confederate Gulch operated by the Diamond City Mines Co. The property was worked intermittently from April to November, and gold bullion valued at about $750 was marketed. The Grub Stake & Snow Shoe and Doggett placers also produced placer bullion.

Beaver district (*Winston*).—Nine lode mines in the Beaver district produced 117 tons of ore, yielding $2,295 in gold, 4,340 ounces of silver, 604 pounds of copper, and 38,152 pounds of lead, valued in all at $5,952 or $50.87 in metals a ton. The value of the district output has decreased steadily since the record of over $75,000 was established in 1927, due chiefly to the suspension of shipments of lead ore from the East Pacific property of the Montana Mines Corporation. Lessees shipped only 2 tons of sulphide lead ore from this property in 1930, and no development was reported. Small lots of siliceous gold ore were shipped from the Doane Incline, Iron Age, Midas, and Black Tail properties. The Standard Silver Lead Co. operated the January mine near Winston, shipped 9 tons of sulphide lead ore to East Helena, and reported 1,000 feet of development. One car of sulphide lead ore was shipped from the Little Olga & Quartette (Kleinschmidt) mine by lessees, but no development was reported. Nearly 3,000 tons of sulphide lead ore of milling grade was produced from the property in 1928. The remainder of the output from this district consisted of oxidized lead ore from the Big Four and Mountain View properties; 300 feet of tunnel work was done at the Big Four. Ore mined at the Top Notch mine 6 miles east of Winston was stored, and development for the year consisted of 300 feet of tunneling and 50 feet of raising.

Cedar Plains district (*Radersburg*).—One placer and 12 lode mines in the Cedar Plains district produced 662 tons of ore, $4,655 in gold, 4,568 ounces of silver, 1,701 pounds of copper, and 240,259 pounds of lead, valued in all at $18,647. The ore yielded on the average $27.18 in metals a ton; the placer output was valued at $654. The value of the district output decreased from $185,708 (90 per cent) in 1929. The 1930 output consisted of 400 tons of smelting ore, 258 tons of concentrating ore which was reduced to 86 tons of concentrates, and 4 tons of gold ore treated by amalgamation. The unusually large decrease in the production from the Cedar Plains district was due chiefly to the suspension of operations early in the year at the Joe Dandy mine of the Butte Copper Consolidated Mines Co. near Radersburg. In 1929 the Joe Dandy mine produced more than 3,000 tons of rich lead ore, and the property ranked fourth as a producer of lead in Montana. The output in 1930 consisted of only 254 tons of oxidized lead ore, shipped to East Helena for smelting. The property is opened by a vertical shaft 600 feet deep and 4,100 feet of lateral workings; only 100 feet of development was done in 1930. A large decrease in output was also reported by the Montana Exploration Co. operating the Keating mine near Radersburg, an important producer of gold since 1911. In 1929 about 3,000 tons of gold-bearing iron ore from the Keating property was treated in a small jig plant; the output in 1930 consisted of only 258 tons of material similarly treated, but new milling equipment was reported to have been installed during the year. Two cars of gold-bearing iron ore were shipped from the Ohio-Keating mine and small lots of gold ore were marketed from the Black Friday, Cyclone, Iron Age, Laura Mae, and Gold Dust properties. A small lot of siliceous gold ore from the district was treated by amalgamation and shipments of oxidized lead ore were made from the Santa Anita, Last Chance, Lucky Jim, and Gopher properties. The Montana Development Co. reported about 200 feet of development in 1930 at the Copper Queen property, a producer of a little copper and lead ore in 1929. A small quantity of placer bullion was marketed from the Radersburg placer.

Park (*Indian Creek, Hassel*) *district* (*Townsend*).—The Iron Mask property near Townsend was not operated, but former lessees shipped a small lot of lead-zinc ore to a custom mill at Butte. A little oxidized lead ore was shipped from the Silver Wave and Sparrow properties.

CASCADE COUNTY

The value of the production of metals in Cascade County was $13,633, a decrease of $211,677 from the output of 1929. This unusually large decrease was due to the idleness of the Silver Dyke mill, which was closed in April, 1929. The property was a large producer of silver, copper, and lead from 1923 to 1929. The output from Cascade County has decreased gradually since 1926, when 13 mines produced metals valued at $1,209,770. The value of the output in 1930 was less than that in any other year since detailed records were started in 1904.

Operations were on a curtailed basis at the copper refinery, rod and wire mill, and electrolytic zinc plant of the Anaconda Copper Mining Co. at Black Eagle near Great Falls. Articles[5] describing these plants were published in August, 1929, and February, 1930. The results of operations at the Great Falls and Anaconda plants are given under Silver Bow County, with other notes of the Anaconda Copper Mining Co.

Montana district (*Neihart*).—The production from the Montana district in 1930 consisted of copper-lead ore of smelting grade and lead-zinc milling ore shipped from the Silver Dyke mine at Neihart by lessees. The output was unimportant when compared with production of the mines at Neihart from 1921 to 1927. The Silver Dyke mine, formerly operated by the Silver Dyke Mining Co., was the largest producer in the Montana district from 1923 to 1930. The property was equipped with a 1,000-ton table and flotation concentrator and in 1928 ranked eighth in the production of silver in Montana, fifth in lead, and sixth in copper. In 1929 the property ranked sixth in the production of copper, ninth in lead, and tenth in silver; it was closed in April, 1929, due to depletion of ore reserves. The Galt Mining Co., a producer of several thousand tons of lead-zinc ore in 1928, and the Queen of the Hills mine of the Queen Mining & Milling Co., also a large producer of lead-zinc ore in recent years, were idle in 1930. No development, other than annual assessment work, was reported from the district in 1930.

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[5] [illegible], A. E., and Caples, R. B., Electrolytic Zinc Practice at Great Falls and Anaconda: Eng. and Min. Jour., vol. 128, Aug. 24, 1929, p. 319.

Mitchell, W. E., Electrolytic Cadmium Plant of Anaconda Copper Mining Co. at Great Falls, Mont.: Trans. Am. Inst. Min. and Met. Eng., February, 1930, p. 239.

DEERLODGE COUNTY

The value of the production of metals in Deerlodge County decreased from $11,882 in 1929 to $4,062 in 1930. Most of the output was gold-bearing iron ore from mines near Southern Cross.

The copper concentrator and copper smelter of the Anaconda Copper Mining Co. at Anaconda were active throughout the year. No major changes were made in the milling and smelting practices. An article [6] describing the reverberatory smelting practice appeared in August. The 12,000-ton concentrator treated copper ore from the mines at Butte, and the concentrates were reduced to blister copper at the rate of about 16,400,000 pounds a month as compared with nearly 25,000,000 pounds a month in 1929. Zinc and lead-zinc ore, chiefly from the mines at Butte, were treated in the 1,750-ton flotation concentrator at Anaconda. The resulting zinc concentrates, together with custom material, were reduced to slab zinc at the electrolytic zinc plants at Anaconda and Great Falls. The zinc output was much less than that in 1929, and due to the suspension of zinc-ore shipments the Anaconda concentrator was closed during November. Articles describing operations at the Anaconda mills and reduction plants were published in the Anaconda number of the Engineering and Mining Journal, August 24, 1929. Interesting experiments in the concentration of low-grade manganese-zinc ore from Butte were conducted at the copper concentrator at Anaconda during 1930. A satisfactory process was reported to have been developed, and several thousand tons of ore carrying 25 to 30 per cent of manganese with some lead and zinc were treated by preferential flotation. The resulting manganese concentrates were shipped to the nodulizing plant at Butte, and lead-zinc concentrates were shipped to the electrolytic plant.

Georgetown district (*Southern Cross*).—Four lode mines in the Georgetown district produced 271 tons of ore, yielding $3,938 in gold, 31 ounces of silver, and 203 pounds of copper, valued in all at $3,976 or $14.67 in metals a ton. The output consisted of gold-bearing iron ore from the Short Shift, Southern Cross, Holdfast, and Gold Coin mines, all near Southern Cross.

Oro Fino district.—The output of the Oro Fino district in 1930, as in 1929, consisted of test lots of gold ore from the Independent mine and silver ore from the Cashier group near Race Track.

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[6] Dougherty, J. J., Effect of High-Grade Concentrates in Reverberatory Practice at Anaconda: Min. and Met., August, 1930, p. 389.

FERGUS COUNTY

The value of the output of metals from mines in Fergus County has declined steadily from the record of more than $80,000 in 1921. No production was reported in 1929, and the output in 1930 consisted of a small shipment of gold bullion from ore treated by amalgamation at a property in Warm Springs district and a small amount of gold bullion from the Plum Creek placer in North Moccasin district. Development was confined to assessment work, except at the Tailholt mine where rich gold ore was being opened.

FLATHEAD COUNTY

The Flathead mine in the Hog Heaven district near Kila was the only producer in Flathead County in 1930. The property is owned and operated by the Anaconda Copper Mining Co. and in 1930 produced nearly 10,000 tons of first-class silver ore which was shipped to the smelter at Anaconda. In 1929 the mine suddenly became an important producer and shipped ore containing nearly 900,000 ounces of silver. In 1930, however, the grade of ore changed, and the production was much less. The operating company reported development consisting of 3,022 feet of drifting and 583 feet of diamond drilling in 1930. The Ole property, adjoining the Flathead mine, was being developed by the Ole Mining Co.; the company reported 560 feet of tunnel work in 1930.

GRANITE COUNTY

The output of the five metals from mines in Granite County decreased decidedly in 1930, and the value of the metal output decreased from $781,565 in 1929 to $363,829 in 1930. The largest decreases were in lead-zinc ore from the Trout and Silver Prince properties and old silver tailings from the Granite Bimetallic dump. An unusually large amount of development was reported at the Trout mine. Manganese operations at Philipsburg were continued during 1930, but the output was much less than that in 1929.

Dunkleberg district.—A small lot of siliceous gold ore was marketed from the Red Wing (Sage Lode) property near Jens.

First Chance district (*Garnet*).—Placer gold was recovered by sluicing operations at the Elfers, Potlatch, and Cayuse placers in Deep Gulch near Garnet.

Flint Creek district (*Philipsburg*).—Three lode mines and one tailings dump in the Flint Creek district produced 12,413 tons of ore and about 7,000 tons of old tailings, yielding $9,310 in gold, 364,407 ounces of silver, 84,161 pounds of copper, 630,156 pounds of lead, and 3,320,510 pounds of zinc, valued in all at $351,441 or $18.10 in metals a ton. In 1929 four lode mines and one tailings dump produced 53,498 tons of ore and old tailings with a total value in metals of $729,179. The large decrease was due to curtailment of lead-zinc operations at the Trout and Silver Prince mines. In 1930 the output of the district consisted of 12,344 tons of milling ore—which, with 7,000 tons of old tailings, was reduced to 3,903 tons of concentrates—and 69 tons of crude ore of smelting grade. The Trout Mining Co. operated the Trout and Algonquin groups and continued to be the leading producer in the district. No silver ore was mined during

1930, but the company shipped more than 10,000 tons of lead-zinc ore to custom milling plants at Butte and Anaconda. The property ranked fifth as a producer of silver and zinc in Montana in 1930, seventh in lead, eighth in copper, and eleventh in gold. In addition to the lead-zinc ore mined the company produced nearly 20,000 tons of manganese ore, which was treated in a 100-ton concentrator using magnetic separation. The manganese concentrates were shipped to eastern markets. The company reported development during 1930 consisting of 190 feet of shaft sinking, 6,000 feet of drifting, and 172 feet of raising. The Silver Prince Mining Co. continued operations at the Silver Prince (Scratchall) mine and shipped about 2,300 tons of lead-zinc ore to custom flotation plants at Butte and Anaconda and one car of silver ore to Anaconda for smelting. In 1929 the property produced over 5,000 tons of lead-zinc ore. The property ranked seventh in the production of zinc in Montana in 1930, and the company reported 1,600 feet of drifts and crosscuts and more than 800 feet of winzes and raises. The Granite Bimetallic Consolidated Mining Co. continued the treatment of old Granite Bimetallic tailings by flotation but at a much lower rate than in 1929. The output consisted of about 300 tons of rich silver concentrates which were shipped for smelting. The remainder of the district output consisted of a test shipment of copper ore from the Basin Lode property at Philipsburg. The Moorlight Mining Co. continued to treat manganese ore from several mines in the district at the magnetic separation mill at Philipsburg; about 7,300 long tons of ore were reduced to 3,263 tons of concentrates which were shipped to eastern battery manufacturers. The company reported $14,487 spent in development at the Eleanor-West Algonquin group, and 1,000 feet of drifting was reported by the North Granite Mining Co. at the Hobo property.

Frog Pond Basin district.—A test lot of sulphide lead ore was shipped from the Gold Leaf property. No production was reported from the Miller claims, 38 miles southwest of Philipsburg, which produced two cars of lead-zinc ore in 1929.

Henderson (Black Pine) district.—The Combination (Black Pine) property, which produced several cars of oxidized copper ore in 1929, was idle in 1930.

Maxville district.—The Gold Coin Mining Co. continued operations at the Copper State (Huffman) property near Maxville. The 75-ton roasting, leaching, and precipitation plant built in 1929 to treat low-grade oxidized copper ore was idle during 1930, but the company shipped several cars of oxidized ore containing about 12 per cent of copper and a little gold and silver to the smelter at Anaconda. The company acquired the Sunrise group of 42 claims near Stone, a station on the Northern Pacific Railway, and reported that a new lower tunnel had been started to open the property at depth. A lessee operated the Hoffman property of the Maxville Gold & Silver Mining & Development Co. and treated several hundred tons of gold and silver ore in the 100-ton flotation plant. Rich silver concentrates were shipped to Anaconda for smelting.

Rock Creek district.—Small lots of bullion were marketed from several placer claims on Rock Creek and its tributaries.

South Boulder district (Maxville).—Placer bullion valued at about $300 was recovered from operations at the Montana Placer property in Princeton Gulch near Maxville.

JEFFERSON COUNTY

The value of the production of metals in Jefferson County was $171,687 compared with $473,077 in 1929. The output of all five metals decreased considerably from that in 1929, due chiefly to fewer shipments of lead-zinc ore from the Comet mine and to inactivity at the Comet tailings dump. Although production was much less than that in 1929, a large amount of development was done at various properties, chiefly by the Basin Montana Tunnel Co. at the Gray Eagle mine and by the Knickerbocker Mines Co. in reopening the old Alta & Bertha group.

Bigfoot district.—The Big Four property on State Creek, which produced more than 600 tons of lead-zinc milling ore in 1929, was idle in 1930.

Boulder district.—No ore was shipped from the Baltimore property 4 miles northwest of Boulder in 1930, although it was a regular producer from 1924 to 1929.

Buffalo Creek district.—A small quantity of placer bullion was recovered by sluicing operations at the head of Buffalo Creek.

Cataract district (*Basin*).—Nine lode mines in the Cataract district produced 10,881 tons of ore, yielding $19,006 in gold, 100,407 ounces of silver, 80,734 pounds of copper, 1,038,305 pounds of lead, and 967,213 pounds of zinc, valued in all at $166,499 or $15.30 in metals a ton. In 1929 1 placer, 8 lode mines, and 1 tailings dump produced 20,044 tons of ore and old tailings with a total value of $425,247. The decrease of $258,748 in the value of the district output was due chiefly to curtailment in the shipments of lead-zinc ore from the Comet mine and to the fact that the Comet tailings dump, which produced 5,000 tons of old tailings containing silver, lead, and zinc in 1929, was not worked in 1930. The district output consisted of 440 tons of first-class smelting ore, 160 tons of siliceous gold ore treated by amalgamation, and 10,281 tons of ore of milling grade which was reduced to 1,580 tons of concentrates. The Comet mine near Basin continued to be the largest producer in the district. The property was operated by lessees who shipped several cars of sulphide lead ore of smelting grade to East Helena and nearly 9,000 tons of lead-zinc ore of milling grade to custom flotation plants at Butte and Anaconda. Shipments were suspended after October 1 due to the closing of the Timber Butte mill at Butte. The lessees did about 350 feet of development, mostly in drifting. The property was reported sold to the Butte Cananea Mining Co. S. A. late in the year. The Gray Eagle mine, also near Basin, was operated by the Basin Montana Tunnel Co. The output consisted of several cars of silver-bearing copper ore of smelting grade shipped to Anaconda and several hundred tons of lead-zinc ore of milling grade shipped to custom flotation plants at Butte and Anaconda. Shipments of milling ore were suspended in October. The ore is hauled 4 miles by truck to Fuller, a shipping point on the Great Northern Railway. The mine is opened by a tunnel and an underground shaft to the 600-foot level. The development in 1930 amounted to about 5,000 feet of drifts, crosscuts, and raises. Preliminary surface work, including an aerial survey, was done preparatory to starting a long tunnel to open the Gray Eagle and other properties at depth. The Bullion mine was operated by the Schmit Bullion Mining Co., and a small flotation mill completed in

1929 treated several hundred tons of sulphide lead ore. The resulting lead concentrates were shipped to East Helena for smelting. The remainder of the district output consisted of siliceous gold ore from the Gray Lead and Earl mines treated by amalgamation, one car of lead-zinc ore shipped by lessees from the Crystal mine, a small lot of sulphide lead ore from the Red Wing property, a little siliceous gold ore from the Hope mine, and a car of siliceous gold and silver ore from the Rumley property. About 200 feet of drifting was reported at the Morning Glory property near Basin, but no ore was shipped or treated during the year. The Katie property of the Jib Mining Co., an important producer of gold in 1924 and 1925, was idle in 1930.

Colorado district (*Wickes*).—The production from the Colorado district in 1930 consisted of a test lot of sulphide lead ore from the Johnson property near Wickes shipped to East Helena. In 1927 the district output was valued at $372,233 and in 1928 at $39,709. The rapid decline in output was due to the marked decrease in the output of lead-zinc ore from the Mount Washington mine and to the suspension of operations at the old Alta tailings dumps. Six lode mines were active in the district in 1929 and produced 1,023 tons of ore valued at $19,832. The Knickerbocker Mines Co., organized in 1929 to reopen the Alta & Bertha property, completed the rehabilitation of the Bertha shaft to the 500-foot level and reopened part of the 500-foot level workings. A little development was reported at the Mina, Minnesota, and Mount Washington mines.

Elkhorn district.—Lessees operated the Dolcoth mine near Elkhorn and shipped 115 tons of sulphide copper ore to Anaconda for smelting. Two cars of siliceous gold ore were shipped from the Haegan mine to Anaconda via Queen Siding, a loading point on the Northern Pacific Railway. A car of siliceous gold ore was also shipped from the Little Goldie property in Sloans Gulch, northeast of Boulder.

Homestake district.—The output of the Homestake district consisted of small lots of siliceous gold ore from the Nellie and Roosevelt properties, a little silver ore from the Charlton mine, and a little placer bullion from creeks near Homestake.

Lump Gulch district (*Clancey*).—A test lot of lead ore from the Irish Syndicate property was shipped to East Helena for smelting. In 1929 the output from five properties in the district was valued at $2,752.

Whitehall district.—Three lode mines in the Whitehall district produced 39 tons of ore, yielding $325 in gold, 237 ounces of silver, 301 pounds of copper, and 23,804 pounds of lead, valued in all at $1,645 or $42.18 in metals a ton. In 1929 the output consisted of 57 tons of ore valued at $1,874. The output in 1930 consisted of small lots of siliceous gold ore from the Sunnyside and Streak of Luck properties and a car of oxidized lead ore from the Surprise mine.

JUDITH BASIN COUNTY

The value of the production of metals in Judith Basin County was $1,043,620 in 1930, a marked decrease from $1,770,231 in 1929. The value of the production, however, was larger than that of any other county in the State except Silver Bow. The St. Joseph Lead Co., the chief producer, curtailed its output of lead-zinc ore decidedly and closed its 400-ton flotation mill in September, but it remained the largest producer of lead in Montana.

Barker district (Hughesville).—Three lode mines in the Barker district produced 82,552 tons of ore, yielding $11,620 in gold, 603,317 ounces of silver, 247,274 pounds of copper, 9,155,321 pounds of lead, and 6,451,404 pounds of zinc, valued in all at $1,043,620 or $12.64 in metals a ton, compared with a total value of $1,770,210 in 1929. The output in 1930 was almost entirely lead-zinc ore of milling grade from the Block P property of the St. Joseph Lead Co. near Hughesville. The ore was treated in the 400-ton flotation plant completed in 1929. The mill is connected with the mine by a 2-mile aerial tramway. The mine and mill were run continuously until September 20, when operations were suspended due to low metal prices. A detailed description[7] of the mill was published early in 1931. According to this article the mill heads contained 6 per cent of lead, 5 per cent of zinc, and 9 ounces of silver to the ton. The chief minerals are galena, sphalerite, marmatite, and pyrite in a gangue of altered syenite and rhyolite. The mill equipment consists of a jaw crusher, Symons cone crusher, rod mill in closed circuit with a duplex classifier, Fahrenwald and St. Joseph flotation machines, and a Dorrco filter. Recoveries were 95 per cent of the lead, 11 per cent of the zinc, and 54 per cent of the silver in the lead concentrates and 81 per cent of the zinc, 1 per cent of the lead, and 27 per cent of the silver in the zinc concentrates. Mine development was continued throughout the entire year; the company reported 211 feet of shaft sinking, 2,582 feet of drifting, and 613 feet of raising, in addition to station cutting. The mine is opened by a vertical shaft 1,470 feet deep and about 31,000 feet of drifts and crosscuts.

The remainder of the district output consisted of two cars of sulphide lead ore from the Liberty mine and a car of oxidized lead ore from the Silver Bell property. About 1,300 feet of development, mostly tunnel work, was reported by the Faith Mining Co., operating the Liberty mine. The Emerald property, a producer of lead-zinc ore in 1929, was idle in 1930.

LEWIS AND CLARK COUNTY

The value of the production of metals in Lewis and Clark County in 1930 was $1,040,845, a decided decrease from $1,646,466 in 1929. The value of the output was nearly the same as that of Judith Basin County, which held second place to Silver Bow County. The largest decrease was in the output of zinc, which declined several million pounds as a result of the curtailment in the treatment of current slag from the East Helena smelter by the Anaconda Copper Mining Co. There were also large decreases in the output of silver and lead but an increase in the production of gold from the Spring Hill mine near Helena, which became the largest producer of gold in Montana. Large decreases in the output of gold were reported from the Drumlummon and Jay Gould mines.

Bald Butte district.—A little slag from former operations at the old Bald Butte cyanidation mill was shipped to a smelter; the Bald Butte mine has been idle since 1927.

Bear Gulch district.—A small lot of rich siliceous gold ore was shipped from the Aurora mine 4 miles north of Rimini, and a little development was done at the property in 1930.

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[7] Vanderburg, W. O., Milling Methods at the Hughesville Concentrator of the St. Joseph Lead Co. Hughesville, Mont.: Inf. Circ. 6447, Bureau of Mines, April, 1931, 16 pp.

Dry Gulch district.—One car of siliceous gold ore was shipped from the San Juan mine 3½ miles south of Helena; a similar shipment was reported from this property in 1929. A test lot of siliceous gold ore was shipped from the Fidelity Gold property, and a little gold ore from the district was treated by amalgamation. The placer output of the district consisted of small lots of bullion recovered by drift mining at the Oro, No. 368, and another placer claim in Dry Gulch.

Gould district.—The Jay Gould mine, which was recently operated by the New Gould Mining Co. and was an important gold producer from 1926 to 1929, was idle in 1930. A small quantity of amalgamation bullion marketed from the property in 1930 was reported as a clean-up from former operations. No development was reported in 1930, but late in the year the Standard Silver-Lead Mining Co. was organized to reopen the mine.

Grass Valley district.—In 1930, as in 1929, a lessee shipped a small lot of oxidized silver-lead ore from the Silver Coin mine.

Helena (Unionville, Spring Hill) district.—The Montana Mines Corporation continued operations at the Spring Hill mine 5 miles south of Helena. The output of gold increased nearly 50 per cent over that in 1929, and the mine was the leading producer of gold in Montana in 1930. Mining and milling operations at the property have been continuous since the mill was remodeled in April, 1929. During 1930 a total of 70,751 tons of gold-bearing iron ore was treated in the flotation mill, yielding 4,394 tons of rich gold concentrates which were shipped to East Helena, Mont., and Tacoma, Wash., for smelting. The Spring Hill ore body occurs as a contact deposit between diorite and limestone, the mineralized zone being about 30 feet wide and at least 750 feet long. The gold is associated with pyrite, arsenopyrite, and a bismuth mineral. Pyrrhotite, the most abundant sulphide mineral in the ore, carries little or no gold. All the ore mined to date has come from above the main tunnel level, either from the surface glory hole or the main shrinkage stope. Development during 1930 included the sinking of a winze 125 feet below the tunnel level. This winze will be continued to a depth of 200 feet, where a haulage and operating drift will be run to the ore body. Other development consisted of 184 feet of raises, 493 feet of drifts, and 883 feet of diamond drilling. No statement of ore reserves was made. The flotation mill was described in a pamphlet[8] issued early in 1931. Since the mill report was written the company has installed a third ball mill (8 feet by 48 inches) and classifier, raising the mill capacity to about 350 tons a day. The remainder of the district output consisted of a small lot of siliceous gold ore from the Souvenir property in Grizzly Gulch and a small amount of amalgamation bullion from a prospect in the district.

Lincoln district.—Small quantities of placer bullion were recovered from sluicing operations at the Harvey placer in Sauerkraut Gulch and from two placers in McClellan Gulch.

Ottawa district (Marysville).—Five lode mines, 2 slag dumps, and 1 tailings dump in the Ottawa district produced 2,571 tons of ore, slag, and old tailings, yielding $14,853 in gold, 6,000 ounces of silver, 6,882 pounds of copper, and 170,736 pounds of lead, valued in all at $26,594 or $10.34 in metals a ton. In 1929 the district output was valued at

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[8] Grant, L. A., Milling Methods and Costs at the Spring Hill Concentrator of the Montana Mines Corporation, Helena, Mont.: Inf. Circ. 6411, Bureau of Mines, March, 1931, 9 pp.

$65,631; the decrease in 1930 resulted from the decreased output of gold from the Drumlummon mine. The output in 1930 consisted of 236 tons of first-class smelting ore, 203 tons of ore treated by amalgamation, 80 tons of ore and 550 tons of old tailings treated by cyanidation, 2 tons of slag sold to a smelter, and 1,500 tons of concentrating ore which made 135 tons of concentrates.

Lessees operated the Drumlummon mine of the St. Louis Mining & Milling Co. of Montana, shipped 133 tons of siliceous gold ore to Anaconda for smelting, treated 200 tons of ore by amalgamation, and shipped a small quantity of old slag to a smelter. Old Drumlummon tailings—about 550 tons—were re-treated by cyanidation. The output of gold from the property decreased from more than 1,600 ounces in 1929 to about 300 ounces in 1930. The property ranked fourth in the production of gold in Montana in 1929 but dropped to tenth place in 1930. No development was reported at the mine during the year. The Metalsmith Mines Corporation, operating the Empire mine 20 miles from Silver, a station on the Great Northern Railway, completed the construction of a 100-ton flotation mill and treated about 1,500 tons of sulphide lead ore which yielded 135 tons of lead concentrates. These concentrates, with a car of oxidized lead ore of smelting grade, were shipped to East Helena for smelting. The mine is opened by a tunnel 2,000 feet long, and about 1,000 feet of drifting was done in 1930.

A lessee, operating the White Aster mine, treated 80 tons of siliceous gold ore by cyanidation. The Piegan-Gloster mine, formerly a large producer of gold and silver, was operated by a lessee who shipped 50 tons of siliceous gold ore to the smelter at East Helena and treated a small lot of gold ore by amalgamation. A car of siliceous gold ore was shipped to Anaconda from the Gold Bar property, and about 250 feet of tunnel work was done. A small clean-up of old slag containing chiefly gold was marketed from the old Gloster mill. A little development was reported at the Neenen property of the Great Divide Mining Corporation and at the Earthquake & General Grant group of the Hope Mining & Milling Co.

Smelter district.—Regular smelting operations were continued at the lead plant of the American Smelting & Refining Co. at East Helena, which treated custom material, chiefly from Montana and Idaho. The receipts were largely sulphide lead ore and concentrates from the Coeur d'Alene region, Shoshone County, Idaho, and residues from the zinc plants of the Anaconda Copper Mining Co. at Great Falls and Anaconda, Mont. The smelter is equipped with a crushing and sampling plant, bedding plant, nine Dwight-Lloyd sintering machines, five lead blast furnaces, a bag house, a Cottrell plant, and various kettles and small furnaces for drossing and casting. No refining is done at East Helena. Lead bullion is shipped to Omaha, Nebr., for refining; speiss and matte containing copper are shipped to Tacoma, Wash.; and a by-product fume rich in cadmium is shipped to Leadville, Colo., for treatment. The output of the smelter, published separately in 1929, was not made public for 1930. The figures of production are included with those of the other plants in the printed report of the American Smelting & Refining Co. Shipments of silver-lead bullion from East Helena in 1930 were about 20 per cent less than those in 1929, when the plant shipped bullion containing 167,562,000 pounds of lead.

The fuming plant of the Anaconda Copper Mining Co. at East Helena was operated continuously on current slag from the lead smelter. The product is an impure zinc oxide containing lead oxide, which is shipped to Great Falls for treatment in the electrolytic zinc plant. The plant was described in an article [9] published in August, 1929. Results of operations were given in the annual report of the Anaconda Copper Mining Co. for 1928, but detailed figures were not published for 1929 or 1930. The output of zinc, however, was considerably less in 1930 than in 1929.

Stemple district.—One lot of siliceous gold ore from the Klondike mine was treated by amalgamation in a small stamp mill, and the resulting bullion was shipped to the assay office at Helena. A little placer bullion was also shipped from the district.

Vaughn district (*Rimini*).—The Montana Lead (Inc.) continued development at the Tatham group on Red Mountain, 12 miles southwest of Helena. Only one small shipment of sulphide lead ore of smelting grade was marketed, but the company did considerable drifting and crosscutting and advanced the new lower tunnel 500 feet to a point 3,400 feet from the portal. Several veins have been cut in the tunnel, and the company reported the opening of considerable complex lead-zinc ore of milling grade. The Porphyry Dike property, operated by the Gold Caps Mining Co. and a producer of more than 4,000 tons of low-grade gold ore treated by amalgamation in 1929, was idle in 1930. A small quantity of bullion was marketed from placer claims in the district.

Wolf Creek district.—The Pentabase Mining Co., organized in 1929 to develop the Honeycomb and Crescent claims, continued operations in 1930 and shipped one car of sulphide copper ore to Anaconda for smelting. About 250 feet of development was done in 1930, mostly in advancing the new tunnel. The property of the Montana Copper & Zinc Co., which shipped copper ore in 1929, was idle in 1930.

LINCOLN COUNTY

The value of the production of metals in Lincoln County decreased from $16,210 in 1929 to $11,074 in 1930. The quantity of ore mined in the county in 1930 increased, but both the lead and zinc recovered decreased. Most of the output was silver-lead ore from the Hazel T. mine of the Glacier Silver-Lead Mining Co. The capacity of the Hazel T. mill was increased to 325 tons a day, and a new 100-ton flotation mill was reported under construction at the property of the Liberty Metals Co.

Libby district.—The Glacier Silver-Lead Mining Co. continued operations at the Hazel T. property and was again the largest producer in the district. The flotation plant treated about 1,700 tons of sulphide lead ore, and the capacity of the mill was increased to about 325 tons a day by the installation of additional equipment. Lead concentrates were shipped to Midvale, Utah, and East Helena, Mont., for smelting. No zinc was recovered in 1930, and the development was not reported. The Rose mine of the Midas Gold Mining Co. 36 miles south of Libby was idle in 1930. The property produced gold ore during 1928 and 1929 which was treated by amalgamation and concentration. A small 10-stamp mill at the Tip Top mine treated 100 tons of siliceous gold ore by amalgamation. The mill was rebuilt in 1930, and concentration equipment was added. The company planned the construction of a new hydroelectric power plant and did 60 feet of tunnel work. A little placer bullion was recovered by sluicing operations at the Nugget, Liberty, and Big Cherry Creek claims. The Golden West Mining Co. did considerable surface work preparatory to opening the Gold Standard & Gold Star group; new truck roads were built, a Diesel engine for the compressor was installed, and a short aerial tramway was built before the new tunnel was started. The Victor Gold Mining Co. reported 435 feet of tunnel work at the Victor-Empire property 11 miles west of Libby.

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[9] Laist, Alexander, Fuming Off Zinc from Lead Slags at East Helena: Eng. and Min. Jour., vol. 128, Aug. 24, 1929, p. 325.

Troy or Callahan Creek district.—The production from the Troy district in 1930 consisted of a small shipment of unusually rich silver ore from surface work at a prospect. The property of the Silver King Mining Co., a producer of several cars of rich sulphide lead ore in 1929, was idle in 1930 except for about 90 feet of tunnel work. The Liberty Metals Co. continued development at its property 6 miles south of Troy. The main tunnel was advanced 400 feet to the 2,000-foot point, and about 75 feet of drifting was done. A 100-ton flotation mill was reported under construction at the end of the year. At the Silver Tip property of the Montana Sunrise Mining Co. a little drifting was done in tunnel No. 10, and a 125-foot raise was put up to tunnel No. 7. The Silver Strike Mining Co. reported 210 feet of tunnel work at a property 6 miles south of Troy; tunnel work was also done at the Robinhood and Black Diamond mines.

Wolf Creek district.—A little placer bullion was marketed from the Grub Stake property on Wolf Creek.

MADISON COUNTY

The value of the production of metals in Madison County decreased from $342,305 in 1929 to $316,745 in 1930. The large decline in the output of silver and lead from the Calvin property near Melrose offset the increase in the production of gold from the property of the Liberty Montana Mines Co. near Jefferson Island. There was also a large production of gold from the Boss Tweed mine near Pony, operated by the Mineral Hill Leasing Co.

Alder Gulch district (Virginia City).—Two placers, four lode mines, and a slag dump in the Alder Gulch district produced 260 tons of ore and three tons of slag, $7,071 in gold, 4,735 ounces of silver, 1,293 pounds of copper, and 1,768 pounds of lead, valued in all at $9,150. The ore, exclusive of the old slag, yielded on the average $21.98 in metals a ton and consisted chiefly of siliceous gold ore of smelting grade. Most of the gold ore, which was shipped to Anaconda for smelting, came from the Thompson (Marietta) property in Barton Gulch. Two cars of rich silver ore were shipped to Anaconda for smelting from the Belle mine 2 miles north of Virginia City, operated under lease by the Ardsley Butte Mines Corporation. Bullion valued at about $3,000 was recovered by amalgamation of old slag from former placer operations. Siliceous gold ore was also shipped from the Fortune and Oro Cache properties. Placer bullion was marketed from the Chambers placer in Alder Gulch and from the Hays claims in Browns Gulch. A small amount of development was reported at the Cornucopia and Barton Gulch lode properties.

Bone Basin district.—A car of oxidized lead ore from the Rattler property was shipped to East Helena for smelting.

Lower Hot Springs district (*Norris*).—Most of the output from the Lower Hot Springs district in 1930 was siliceous gold ore from the Galena property, treated in a small flotation plant by the Empire Mines Co. On December 11, 1930, the property was sold to the Empire Gold Mines Co. A small lot of siliceous gold ore from the Birdia mine was shipped to a smelter, and a small amount of amalgamation bullion was marketed from ores mined in the district. A little development was reported at the Birdia mine and at the Valdez property.

McCarthy Mountain district.—Four lode mines in the McCarthy Mountain district produced 249 tons of ore, yielding $1,258 in gold, 8,842 ounces of silver, 290 pounds of copper, and 53,949 pounds of lead, valued in all at $7,397 or $29.71 in metals a ton. The output was chiefly lead ore of milling grade from the Polly Jane mine, 13 miles from Twin Bridges, which was treated in a small table concentrator; lead concentrates were shipped to Midvale, Utah, for smelting. About 600 feet of development was reported at the Polly Jane mine in 1930, including 300 feet of tunnel work and 100 feet of shaft sinking. Oxidized lead ore of smelting grade was shipped from the Vermont and Contentment properties. Lessees operated the Hidden Treasure mine 9 miles from Glen, treated a test lot of siliceous gold ore by amalgamation, and shipped a small lot to a smelter. The smelting ore contained nearly 5 ounces of gold to the ton.

Mineral Hill district.—The Mammoth mine and flotation mill of the Liberty Montana Mines Co. 16 miles south of Jefferson Island were operated continuously during 1930, making concentrates containing chiefly gold and copper. The output of gold increased 11 per cent over that in 1929, and the property again ranked third in the output of gold in Montana. The flotation mill, which has a capacity of 150 tons a day, treated about 30,000 tons of copper ore, and the company shipped about 2,500 tons of concentrates to Anaconda for smelting. The company also reported $10,470 spent on development at the mine during the year. The Boss Tweed property was operated under lease by the Mineral Hill Leasing Co., and more than 2,500 tons of siliceous gold ore were treated in a 10-stamp amalgamation and concentration mill. Mill bullion, valued at about $2,400, was shipped to the assay office at Helena, and 122 tons of concentrates containing nearly 400 ounces of gold were shipped to a smelter. On November 10, 1930, the property was leased to the Mineral Hill Gold Mines (Inc.).

Norwegian district.—The Norwegian placer on Norwegian Creek was active for the first time since 1927. The property was operated by the Itsik Mining Co., and bullion valued at nearly $2,000, recovered by steam shovel and sluicing methods, was deposited at the Denver Mint. Small test lots of siliceous gold ore were shipped from the Amy Louise, Gold Bug (Red Chief), and White Pine properties.

Rabbit district.—Six lode mines in the Rabbit district produced 1,218 tons of ore, yielding $1,438 in gold, 14,401 ounces of silver, 1,551 pounds of copper, and 433,632 pounds of lead, valued in all at $28,866 or $23.70 in metals a ton, compared with a total value of $86,526 in 1929. Most of the decrease was due to the smaller output of lead ore from the Emma and Calvin mines. The output consisted of 517 tons of first-class smelting ore, 1 ton of ore amalgamated, and 700 tons of milling ore which was reduced to 157 tons of concentrates. Most of the output was lead ore of milling grade from the Emma mine 11 miles southwest of Twin Bridges, operated by the Butte-Madison Mines Corporation. The ore was treated in a small flotation mill, and the concentrates were shipped to East Helena for smelting. The output in 1930, however, was only a third of that in 1929. The Commonwealth Lead Mining Co. continued operations at the Calvin mine 6 miles east of Melrose and shipped oxidized lead ore to Midvale, Utah, for smelting. The output was only about one-sixth that in 1929, and the company reported a deficit due to the low price of lead and silver. About 1,000 feet of development was done at the mine during 1930. Several cars of oxidized lead ore were shipped from the Jack Rabbit mine 6½ miles east of Melrose, and about 200 feet of development was reported. Small lots of lead ore were shipped from the Lindbergh and Ajax properties, and a little siliceous gold ore from the Gold Stock claim was treated by amalgamation.

Ramshorn district.—The placer output from the Camp Bird, McKay, Holst, and other properties in the Bevins Gulch section was valued at $1,273 in 1930 compared with $1,603 in 1929. About 100 tons of dump ore from the Goldsmith mine was treated in a small amalgamation mill, and bullion valued at about $700 was sent to Helena. Small lots of siliceous gold ore from the Goldsmith and First Chance mines were shipped to a smelter.

Sand Creek district.—A car of siliceous gold ore was shipped to Anaconda from the Chile mine near Willow Creek.

Sheridan district.—Two placers and six lode mines in the Sheridan district produced 2,936 tons of ore, $11,434 in gold, 4,379 ounces of silver, 8,115 pounds of copper, 81,981 pounds of lead, and 19,038 pounds of zinc, valued in all at $19,188, compared with a total value of $19,619 in 1929. The placer output was valued at $337. The ore yielded on the average $6.42 in metals a ton and consisted of 108 tons of first-class smelting ore, 1,232 tons of ore amalgamated, and 1,596 tons of milling ore which was reduced to 169 tons of concentrates. The chief producers were the Buckeye mine and the Emma B. group. Most of the district output was lead ore and lead-zinc ore from the Buckeye mine of the Vigilantes Mining Corporation. The lead-zinc ore was shipped to a custom flotation plant at Butte, and the lead ore was treated in the company's 75-ton flotation plant; operations were suspended in June. The Smuggler Mining Co. worked the Emma B. mine and treated about 1,100 tons of siliceous gold ore in a 100-ton amalgamation and concentration mill. No concentrates were made in 1930, but bullion valued at about $6,600 was shipped to Helena. The company did about 300 feet of drifting and 100 feet of winze work. The Broadgauge-Tamarack Mining Co. did about 500 feet of development at the Tamarack mine and treated about 80 tons of siliceous gold ore by amalgamation in a 20-ton mill. A car of siliceous gold ore was shipped to a smelter from the Red Pine property by lessees, who did about 100 feet of drifting. A test lot of lead-zinc ore from the Flagstaff mine was shipped to Butte for milling. Two placers on Wisconsin Creek yielded bullion which was shipped to Helena.

Silver Star district.—Siliceous gold ore from the Broadway and Lucky Moon properties near Silver Star was shipped to Anaconda for smelting. About 500 feet of development, mostly drifting, was done at the Strawn group during the year.

Summit district.—About 100 tons of siliceous gold ore from the Mountain Flower mine were treated by amalgamation, and the resulting bullion was valued at nearly $300. About 200 feet of development was done.

Tidal Wave district (*Twin Bridges*).—Ten lode mines in the Tidal Wave district produced 143 tons of ore in 1930, yielding $5,067 in gold, 790 ounces of silver, 840 pounds of copper, and 21,414 pounds of lead, valued in all at $6,551 or $45.81 in metals a ton, an increase from $1,125 in 1929. Most of the output was siliceous gold ore of smelting grade from the Humming Bird, Corncracker, Agitator, B. & H., New York, High Ridge, and Granger properties. Oxidized lead ore was shipped from the Ella and Tipperary properties, and a test lot of oxidized copper ore was shipped from the Urbain mine. About 300 feet of development was done at the Ella property. Limited development was also reported at the Dutchland, Robin, and Pete & Joe properties.

Upper Hot Springs district.—Test lots of rich gold ore were marketed from the Blue Grouse and Mountain View properties near Norris.

Washington district (*Meadow Creek*).—Test lots of unusually rich gold ore were shipped from the Lehigh and Highland Lady No. 2 claims near Norris. The Montana Lead & Zinc Co. advanced the tunnel on the Twin Lakes property 400 feet to a point 1,500 feet from the portal. A little tunnel work was also done at the Snowslide group near McAllister.

MEAGHER COUNTY

Beaver Creek district.—A small quantity of placer bullion was recovered by hydraulicking on the Klondike ground on Beaver Creek near Watson.

Castle Mountain district.—No production was reported from the Castle Mountain district in 1930, but about 1,500 feet of tunnel work was reported at the Great Western group.

Murray (*Battle Creek*) *district.*—The Copper Glance property near White Sulphur Springs, a producer of copper ore in 1929, was idle in 1930.

MINERAL COUNTY

The value of the production of metals in Mineral County decreased from $22,978 in 1929 to $12,615 in 1930, chiefly because of the decline in the shipments of lead-zinc ore from the Iron Mountain property, 4 miles north of Superior.

Cedar Creek district (*Iron Mountain, Quartz*).—Seven placers in the Cedar Creek district produced gold valued at $1,342 in 1930 compared with five placers and a value of $1,804 in 1929. The gold ranged in fineness from 0.967 to 0.989. The Stockholm and Dakota placers on Quartz Creek, which were the largest producers in the Cedar Creek district, were worked by sluicing. Other producers were the Stemwinder placer on Snowshoe Creek, the property of the Irene Lu Mines (Inc.) on Windfall Creek, the Eddy placer of the Higley Mining Co. on Deep Creek, and the Lolo property in Tuckers Gulch.

Iron Mountain district (*Superior, Iron Mountain*).—Lessees again operated the Iron Mountain mine 3½ miles north of Superior and shipped about 350 tons of lead-zinc ore to custom plants at Butte and Anaconda for milling. The output was slightly less than that in 1929. No placer production was reported in 1930 from properties on Oregon Creek.

St. Regis district.—A little rich gold ore from the Lenora mine, which has been idle since 1926, was treated in a hand mortar, and one lot of bullion was sold in Spokane, Wash. No production was reported from the Rock Island property.

Trout Creek district.—Small lots of placer gold were marketed from properties on Trout Creek, and the International Exploration & Development Co. did a little exploration work on a tract of 800 acres of placer ground.

MISSOULA COUNTY

Elk Creek district.—A little bullion was marketed from placer operations at a property on Elk Creek, near Bearmouth.

Nine Mile district.—The placer output from six properties in the Nine Mile district was valued at $1,358 in 1930 compared with $360 in 1929. The Easy Strike property on McCormick Creek near Stark was the chief producer in the district; placer gold was also marketed from the Easy Find on Marion Creek, the Deron & Barrett and Boyd groups on Nine Mile Creek, and the Golden Snake in Dry Gulch.

Wallace district.—Two cars of sulphide copper ore from the Hidden Treasure (Stephens) property near Clinton were shipped to Anaconda for smelting. A test lot of lead ore was shipped from the Montana Center property south of Potomac.

PARK COUNTY

The value of the metal production in Park County decreased decidedly—from $18,595 in 1929 to $729 in 1930—as a result of the inactivity at the property of the Irma Mines (Inc.) near Cooke. No gold ore was mined or treated at the Jardine mine in 1930, but a car of rich tungsten concentrates was marketed.

Cowles district.—Bullion valued at about $100 was recovered from sluicing operations at two placers on Basin Creek.

Emigrant Creek district.—The Yellowstone Gold Mining Co. operated the Upper Falls & Hy-grade placers from June until November and treated about 400 cubic yards of gravel by hydraulicking; the bullion was not marketed in 1930. Placer bullion was also recovered at the Smuggler property.

New World district (Cooke).—The only output from the New World district in 1930 was a test lot of oxidized lead ore from the Mohawk property on Woody Mountain near Cooke. The Irma Mines (Inc.) reported about 100 feet of development at the Irma & Republic mine, but no ore was shipped. In 1929 the Irma property produced more than 400 tons of lead ore of smelting grade. The Glengarry Mining Co. continued development at the Montana & Scotch Bonnet group and reported total expenditures of nearly $95,000. The main tunnel was said to have been advanced to the 2,400-foot point and rich gold-copper ore opened. A comprehensive report [10] on the New World district, published in 1930, gives detailed descriptions of the important mines and the general geology of the region.

Sheepeater district.—The Jardine Mining Co., a large producer of gold ore from 1922 to 1926, treated no gold ore in 1930 and made no white arsenic in the arsenic plant. The company did about 300 feet of development at the property and mined considerable tungsten ore (scheelite) associated with arsenopyrite, which was treated in that part of the mill equipped for gravity concentration. To remove the arsenic, the concentrates were roasted in a 4 by 10 foot reverberatory furnace which was installed during the year. The calcine, which contains about 74 per cent of tungsten trioxide, was shipped to an eastern steel plant. About 25 tons of this material was sold in 1930, and the company had a similar quantity on hand at the close of the year. As the mine was not regularly operated for the recovery of gold and comparatively little development was done, no printed report was issued for 1930.

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[10] Lovering, T. S., The New World or Cooke City Mining District, Montana: U. S. Geol. Survey Bull. 811-A, 1930, 87 pp.

PHILLIPS COUNTY

The production of metals in Phillips County was valued at $14,263 in 1930, an increase from $1,219 in 1929, due to the production of high-grade gold ore from the August mine 1½ miles north of Landusky.

Little Rockies district.—A car of unusually rich gold ore averaging more than 15 ounces of gold to the ton was shipped from the August mine 1½ miles north of Landusky. The property was a large producer of gold in 1924 but has been idle since 1925. Small lots of very rich gold ore were also shipped from the Mint & Badger (Ruby Gulch), an important producer in 1923, and the Red Top mines. A little gold ore from the Beaver Creek district was treated by amalgamation.

POWELL COUNTY

The production of metals in Powell County was valued at $6,598, an increase of $728 over the output in 1929. The output was chiefly sulphide silver-lead ore from the Flora Best property 8 miles south of Elliston and gold ore from the Black Jack mine.

Big Blackfoot district.—A test lot of gold ore from the property of the Blackfoot Gold Mining Co. 8 miles east of Helmville was shipped to a smelter, and a small lot was treated by amalgamation in a new 30-ton mill erected at the property. Placer gold was marketed from two properties near Ogden Mountain.

Blossburg district.—A little gold ore from the N. P. Tract property was treated in a small amalgamation mill.

Nigger Hill district (*Elliston*).—Three lode mines in the Nigger Hill district produced 61 tons of ore, yielding $854 in gold, 1,770 ounces of silver, 230 pounds of copper, and 26,709 pounds of lead, valued in all at $2,902 or $47.57 in metals a ton. The output was all first-class smelting ore, chiefly siliceous gold ore from the Black Jack mine and sulphide silver-lead ore from the Flora Best property. A little lead ore was also shipped from the Emilda property. A little development was reported at the Telegraph and Charter Oak properties.

Ontario district.—A small lot of bullion was recovered from sluicing operations at the Eddie placer 12 miles from Elliston.

Ophir district.—Small lots of siliceous gold ore were shipped from the Victory and Last Chance properties near Avon. A little placer gold was recovered at the Jim Hill group in Snowshoe Gulch.

Pioneer district (*Gold Creek*).—Five placers and two lode mines in the Pioneer district produced 3 tons of ore, $1,369 in gold, and 16 ounces of silver, valued together at $1,375. The ore averaged $208 in metals a ton and was chiefly siliceous gold ore from the Pioneer group treated by amalgamation. The placer output, valued at $751, was produced chiefly from the Ballard, Friday, Pikes Peak, and Surbaugh properties near Gold Creek. It was reported that the Gold Creek Mining Co., operating 5,500 acres of placer ground near Pioneer, had ordered a dredge for work on Gold Creek, but the machinery had not been erected at the end of 1930. The Pioneer lode mine was under development by the Pioneer Minerals Corporation, and total expenditures of about $5,000 were reported.

Washington Gulch district.—Placer bullion valued at about $700 was recovered by sluicing operations at the Fontana placer in Washington Gulch.

Zosell district.—A small lot of gold ore was shipped from the Blue Eyed Maggie mine.

RAVALLI COUNTY

Overwich district.—A little placer bullion was marketed from the Wood property on Hughes Creek.

SANDERS COUNTY

The production of metals in Sanders County in 1930 was valued at $140,334, a marked increase from that in 1929. The large increase was due almost entirely to the mining of lead ore by the Jack Waite Mining Co. from property extending over the divide between Idaho and Montana.

Burns district.—The Princess Gold Mining Co. continued development work at the Iron Daisy group 12 miles southeast of Thompson Falls. About 800 feet of development was done in 1930, and a small lot of gold ore taken out during development was treated in a small gravity-concentration mill built in 1930. Several small lots of gold concentrates were shipped to the smelter at East Helena.

Eagle district.—The Jack Waite Mining Co. of Wallace, Idaho, continued operations at the property in Eagle district, Shoshone County, Idaho. The group extends from the western side of the divide at the head of Tributary Creek over the Bitterroot Mountains into Sanders County, Mont., and mining operations conducted from the Idaho side extracted ore from both States in 1930. The output from Montana consisted of about 14,000 tons of ore, chiefly of milling grade. This material, which was treated in the company's 150-ton flotation plant northeast of Murray, Idaho, made lead concentrates which were shipped to the Bunker Hill smelter at Kellogg, Idaho. A few cars of rich sulphide lead ore were shipped directly to the smelter.

Thompson River district.—A small lot of very rich silver ore, hand sorted during development operations, was shipped from a prospect near Thompson Falls. Development was continued at the Copper Mask property near Thompson Falls, and about 600 feet of drifting and crosscutting was done during the year.

SILVER BOW COUNTY

Sixteen mines and two dumps in Silver Bow County were productive in 1930, but most of the metal output resulted from the operations of four companies at Butte. Some of the large producing mines at Butte were closed during the year due to the low price of metals, and the output of all metals decreased considerably. The value of the gold output decreased $270,500, the output of silver decreased 4,661,361 ounces, that of copper 100,844,336 pounds, that of lead 11,398,354 pounds, and that of zinc 73,132,533 pounds. The total value of the metals decreased $36,387,744 from that in 1929. The larger part of the ore and old tailings mined or treated was concentrated at milling plants at Butte and Anaconda; the resulting products consisted of copper concentrates, lead concentrates, zinc concentrates, lead-zinc concentrates, and copper-lead concentrates. These concentrates yielded metals valued at $26,553,912 or $58.14 a ton of concentrates. The crude smelting ore yielded on the average $17.29 in metals a ton. Old copper tailings and slime-pond material, amounting to 29,736 tons, were smelted. Of the total output of ore, old tailings, etc., nearly 94 per cent was classified as copper material.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1929 and 1930, in terms of recovered metals

Year	Mines producing	Ore, old tailings, etc.	Gold (lode and placer)	Silver (lode and placer)	Copper [1]	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	33	4, 271, 213	$538, 688	9, 918, 906	296, 316, 277	16, 478, 575	101, 100, 505	$65, 687, 913
1930	18	2, 351, 836	268, 188	5, 257, 545	195, 471, 941	5, 080, 221	27, 967, 972	29, 300, 169

[1] Includes copper recovered from precipitates, as follows: 1929, 6,464,032 pounds; 1930, 11,465,232 pounds.

Butte or Summit Valley district.—Fourteen lode mines and two dumps in the Butte or Summit Valley district produced 2,351,832 tons of ore, old tailings, etc., yielding $268,066 in gold, 5,257,529 ounces of silver, 195,471,941 pounds of copper (including 11,465,232 pounds from precipitates), 5,079,925 pounds of lead, and 27,967,972 pounds of zinc, valued in all at $29,300,026, a decrease from $65,687,609 in 1929. An unusually large decrease was recorded in the production of all five metals. Excluding the value of the copper recovered from precipitates, the ore, old tailings, etc., yielded on the average $11.82 in metals a ton. In 1930 the ore output consisted of 63,324 tons of first-class smelting ore, 29,736 tons of old tailings and pond slimes smelted, and 2,258,772 tons of concentrating ore which was reduced to 456,691 tons of concentrates. The mines at Butte have been productive for nearly a half century, and rich copper ore is still being mined at great depth.

From the beginning of activities in 1882 to the end of 1930 Silver Bow County, which includes the Butte district, has yielded gold, silver, copper, lead, and zinc valued at $2,148,710,333, as follows: Gold, $37,080,583; silver, $327,928,093; copper, $1,555,415,748; lead, $21,016,091; and zinc, $207,269,818. These values represent 1,793,773.15 ounces of gold, 456,824,996 ounces of silver, 10,102,609,390 pounds of copper, 314,289,223 pounds of lead, and 2,567,395,925 pounds of zinc.

According to the printed annual report for 1930 the mines of the Anaconda Copper Mining Co. continued to produce copper ore and zinc ore, but the quantity of each was not published. The company curtailed its output of copper ore and zinc ore considerably and closed some of the mines, as a result of low metal prices. The Anaconda works produced 197,233,145 pounds of fine copper, 5,569,147 ounces of silver, and 21,209 ounces of gold, and the greater part of this output came from the copper mines of the Anaconda Copper Mining Co. at Butte. A large quantity of silver and copper was recovered by the treatment at Anaconda of old tailings and slimes from ponds near the smelter, and a large quantity of copper was also recovered from precipitates. The company was the largest producer of silver and copper in Montana and ranked second in the production of gold.

The electrolytic copper refinery and the rod and wire mill at Great Falls were active throughout 1930, but details of operations were not published in the company's annual report.

Zinc concentrates and lead-zinc concentrates were received at Anaconda and Great Falls from the mills at Butte and Anaconda and from the plants in Utah, Idaho, and Montana. The electrolytic zinc plants at Anaconda and Great Falls produced 226,555,255 pounds of slab zinc. In addition, metals in dross and residue amounted to 5,918,479 pounds of zinc, 14,459,634 pounds of lead, 1,871,386 pounds of copper, 2,538,407 ounces of silver, and 7,763.48 ounces of gold. Of this amount 1,849,515 pounds of copper, 341,606 ounces of silver, and 160.32 ounces of gold were treated through the operations of the copper plant. Dividends amounting to $44,219,676 were paid in 1930 by the Anaconda Copper Mining Co.; the net income for the year was $18,782,968, which, added to the balance at the end of the year, gives a surplus of $87,442,901 after deduction of dividends. The company's annual report reads:

> The world-wide depression in business, that marked the closing quarter of 1929 and which continued throughout 1930, resulted in a decreased consumptive demand for the metals produced by your company and the products manufactured therefrom. * * *
>
> The gross sales and earnings of the company in 1930 totaled $179,332,797.51 compared with $305,751,876.46 in 1929. The resulting income for the year after deducting all operating expenses, all taxes, and interest, was $27,034,955.98, from which there was deducted $8,251,987.76 to cover depreciation and obsolescence, leaving a net income to $18,782,968.22, of which $420,692.61 accrued to minority interests.
>
> Construction expenditures during the year amounted to $399,674 at the Butte mines, $58,919 at Anaconda, and $169,833 at Great Falls.

In 1930, as in the past, the company also did a large business in lumber, coal, fertilizer, arsenic, and sulphuric acid in Montana; in manufacturing and refining in the East; in mining, milling, and smelting in Utah, Arizona, California, and Colorado; and in mining and milling in South America and Europe. An interesting series of four articles describing ore hoisting, design and construction of steel and wooden headframes, and other features of hoisting in the Butte region appeared in the Engineering and Mining Journal in May, June, July, and September. A comprehensive summary [11] of conditions at the Butte mines of the Anaconda Copper Mining Co. was recently published in the Mines Handbook. It includes a list of the mines with the general development of each, the general geology of the region, and a description of the mining methods and equipment used. The plants at Anaconda and Great Falls are also described, as well as other mines and plants in Utah, Arizona, and South America.

The Emma mine of the Butte Copper & Zinc Co. continued to be operated by the Anaconda Copper Mining Co.; its production of metals, however, was less than half that in 1929. The chief output of the mine was lead-zinc ore, which was shipped to the Timber

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[11] Rand, L. H., and Sturgis, E. B., The Mines Handbook: Vol. 18, 1931, p. 80.

Butte plant for milling. The property ranked second as a producer of lead, third as a producer of zinc, and seventh as a producer of silver in Montana in 1930. The Anaconda company also sold 38,444 short tons of manganese ore from the Emma mine. Most of this ore was sold to the nodulizing plant at Butte, but a little was shipped to consumers. It was sold for $359,329. The mining of lead-zinc ore was suspended during June, but the output of manganese ore continued throughout most of the year. From 79,508 tons of lead-zinc ore and manganese ore the Butte Copper & Zinc Co. received $70,293; it received $232,013 in 1929. After other income amounting to $12,453 was added the total income for 1930 was $82,746. The net loss, after $84,566 was deducted for various expenses, including $27,564 for suspension of zinc production, was $1,820; the surplus on December 31, 1930, was $562,800. The company paid no dividends in 1930. The following paragraph is taken from the printed report of the Butte Copper & Zinc Co. for 1930.

> We were obliged to temporarily suspend operations at the mine during June, but owing to a manganese contract with the Colorado Fuel & Iron Co. we were enabled to partially reopen the property around the end of August. We were fortunate in having this contract, as we were thus enabled to cut down the great bulk of our so-called "shutdown" expenses and, again, most fortunate in the fact that, during the time of the temporary shutdown, we were not encroaching on our high-grade zinc ore reserves, which are being kept intact in the mine.

The Black Rock property of the Butte & Superior Mining Co. was worked on a 1-shift basis until May and on a development basis until November, when it was permanently closed due to the exhaustion of the commercial ore reserves. The company shipped 79,242 tons of zinc ore and 729 tons of copper ore to the flotation plants of the Anaconda Copper Mining Co. The output of zinc ore decreased 65 per cent and the production of copper ore 86 per cent as compared with 1929. The property, however, was again the largest zinc producer in Montana and supplied nearly 34 per cent of the total zinc output of the State; it also ranked fourth in the production of silver, copper, and lead. As the expenses greatly exceeded the income for the year, the Butte & Superior Mining Co., formerly an important dividend payer, made no disbursements in 1930. As a result of ore sales the company received only $526,688, compared with $2,115,632 in 1929. The cost of mining, development, and general expense was $782,136, leaving an operating loss of $255,448, compared with an operating loss of $18,285 in 1929. After other income of $17,289 was added and $5,667 for accrued taxes deducted, the net loss, without deduction for depletion, was $243,826, compared with a net loss of $5,983 in 1929. The following paragraphs are taken from the company's printed report for 1930.

> Development work consisted of 11,358 feet of drifts and crosscuts and 1,670 feet of raises, or a total of 13,028 feet.
>
> Exploration work was continued during the year but with practically no beneficial results. At the end of the year all development work was stopped, and the mine is being prepared for permanent abandonment. * * *
>
> The total production of zinc ore amounted to 79,242 dry tons during the year containing 653 ounces of gold, 522,280 ounces of silver, 346,373 pounds of copper, 1,939,445 pounds of lead, and 21,000,962 pounds of zinc. The average assay was 0.0082 ounce of gold, 6.59 ounces of silver, 0.22 per cent of copper, 1.22 per cent of lead, and 13.25 per cent of zinc. * * *
>
> The total production of copper ore amounted to 729 dry tons during the year containing 2.77 ounces of gold, 4,886 ounces of silver, 25,914 pounds of copper,

> 2,068 pounds of lead, and 63,423 pounds of zinc. The average assay was 0.0038 ounce of gold, 6.70 ounces of silver, 1.78 per cent of copper, 0.14 per cent of lead, and 4.35 per cent of zinc. * * *
>
> Since the inception of your company's productive operations the distributions paid to stockholders have mounted in total to $20,277,531.43, equal to $69.87 per share on the 290,197.7 shares outstanding at the present time. During the period stated there was produced 5,884,603 dry tons of zinc ore with a net salable metal content of 1,717,074,872 pounds of zinc, 37,182,642 ounces of silver, and 148,965,205 pounds of lead and, in addition, 558,685 dry tons of copper ore containing the following metals paid for: 44,133,709 pounds of copper and 3,366,644 ounces of silver.

The East Butte Copper Mining Co. operated its Pittsmont mine for 10 months of the year, but the property was closed during November; early in 1931 the company's assets were being liquidated. During 1930, 46,025 tons of sulphide copper ore containing 230,984 ounces of silver and 4,459,362 pounds of copper were shipped to the copper flotation mill at Anaconda. The company also marketed 21 tons of copper precipitates containing 30,464 pounds of copper. Development consisted of 2,580 feet of drifting and crosscutting in 1930. The property ranked third as a producer of copper and sixth as a producer of silver in Montana in 1930, although the output was considerably less than that in 1929. No annual statement was printed by the company covering 1930 operations.

The North Butte Mining Co. continued operations at its Granite Mountain and Main Range properties throughout the year. The Granite Mountain mine produced 65,921 tons of copper ore containing 340.70 ounces of gold, 205,681 ounces of silver, and 5,539,783 pounds of copper. The property ranked second in the production of copper and eighth in the production of silver in Montana in 1930. The ore was shipped to the copper flotation plant of the Anaconda Copper Mining Co. and had a net value of $390,547. After $349,648 was deducted for operating expenses, including mining, taxes, and insurance, the net income was $40,899, which, with miscellaneous income of $5,885, made a total net income of $46,784. After $20,500 was deducted for depreciation and $37,898 for miscellaneous expenses the net loss for 1930 was $11,614. Development at the Granite Mountain mine during 1930 consisted of 2,764 feet of drifting, 1,396 feet of crosscutting, 1,363 feet of raising, and 151 feet of winze work. No ore was shipped from the Main Range property during 1930, but development consisting of 5,893 feet of drifting and crosscutting, 1,187 feet of diamond drilling, and 6,840 cubic feet of station cutting was done. The following notes are taken from the company's annual report for the year ended December 31, 1930.

> Due to the abnormally low zinc and silver markets during the past year mining of zinc ore, which was suspended in December, 1929, was not resumed, and no development for the purpose of opening up the zinc orebodies in the northerly portion of the property was undertaken. The stopes on the Edith May vein above the 3,200 and 3,400 foot levels were reopened and contain a large tonnage of high-grade copper ore. Only the Edith May vein has been developed on these levels; but in an adjoining mine to the west numerous veins have been developed by drifts extending to the Granite Mountain line on the 3,000, 3,200, 3,400, and 3,600 levels, disclosing high-grade copper ore, and the extension of these orebodies into the Granite Mountain will undoubtedly be proven as these veins are developed in North Butte ground. On the 3,400-foot level a drift has been recently driven for about 50 feet northwesterly on the footwall branch of the Edith May vein, in the breast of which drift there is over 8 feet in width of ore carrying over 11 per cent of copper. This vein has not been previously developed on any of the lower levels of the Granite Mountain but has been opened in the adjoining mine to the west, where high-grade oreshoots have also been developed. From the present

> face to our property line is 1,100 feet, and it is probable that a very large tonnage of high-grade ore will be developed in this vein from the 2,600-foot level downward.
>
> Late in 1929 the crosscut on the 2,200 level of the Main Range mine was extended through the continental fault, beyond which a station was cut for diamond drilling. From this station a diamond drill hole was extended easterly 190 feet. A second hole was extended southerly 769 feet, and a third hole was drilled northerly 229 feet. This drilling was done to drain the ground east of the fault. * * *
>
> Excellent progress was made throughout the year in the development of the Main Range mine, and your engineers and geologists are firmly of the opinion that the work which has been done and is now being done will prove the existence of extensive copper orebodies to the east of the continental fault and result in a substantial addition to the proven productive area of the Butte district.

The Magnolia mine and the Paymaster group (part of the Curry mine), owned by the Anaconda Copper Mining Co., were operated by lessees during 1930. About 3,200 tons of lead-zinc ore of milling grade was shipped to the Timber Butte and Anaconda flotation plants for treatment. The output was nearly 40 per cent less than that in 1929. Several cars of sulphide copper ore of smelting grade were shipped to Anaconda from the Lizzie mine, and about 100 tons of lead-zinc ore were shipped to the Timber Butte plant for milling. The mine was idle the latter part of the year. The Ardsley Butte Mines Corporation, which shipped more than 8,000 tons of rich silver-lead-zinc ore from its Agnes-Highland group in the southwestern part of the district in 1929, did no work at the property in 1930. A few cars of ore from clean-up operations were shipped to Timber Butte. The mine was allowed to flood early in the year. The adjoining Goldstream property of the Ardsley Butte Extension Mining Co. was also idle in 1930, although the property produced more than 7,600 tons of ore in 1929. Other producers in the district were the Amy Silversmith, Eveline, Silver Bow, Venus, Sailor's Dream, and C. & M. properties. The Poser mine of the Anaconda Copper Mining Co., a large producer in 1929, was idle during 1930, but several thousand tons of ore mined in 1929 were treated at the Anaconda mill.

Divide Creek district.—A small test lot of sulphide lead ore, rich in gold, was shipped from the Alice mine.

Lost Child district.—A little gold ore from the Portland mine was treated by amalgamation.

STILLWATER COUNTY

Stillwater district.—One car of low-grade copper ore was shipped from the Roughnock mine near Nye. The property is opened by 10,000 feet of tunnels, and about 200 feet of drifting was done in 1930.

ZINC[1]

By Elmer W. Pehrson[2]

CONTENTS

Page
- General summary 431
- Production 433
  - General 433
  - Primary zinc 434
  - Distilled and electrolytic zinc 435
  - Rolled zinc 437
  - Zinc dust 439
  - Zinc pigments and salts 440
  - Secondary zinc 441
  - By-product sulphuric acid 442
  - Mine production 444
  - Flotation concentrates 444
- Zinc-reduction plants 445
  - Zinc smelters 445
  - Electrolytic plants 446
- World aspects 447
  - World mine production 447
  - World smelter production 448
  - World zinc industry 450
    - Algeria 450
    - Australia 450
      - New South Wales 451
      - Queensland 452
      - Tasmania 452
    - Belgium 453
    - Bolivia 453
    - Canada 453
      - British Columbia 454
      - Manitoba 455
      - Northwest Territories 456
      - Nova Scotia 456
      - Ontario 457
      - Quebec 457

Page
- World aspects—Continued.
  - World zinc industry—Continued.
    - France 457
    - Germany 458
    - Great Britain 458
    - India 459
    - Indo-China 459
    - Italy 460
    - Japan 460
    - Mexico 460
    - Netherlands 461
    - Newfoundland 461
    - Norway 461
    - Peru 462
    - Poland 462
    - Rhodesia (Northern) 462
    - Russia 462
    - Spain 463
    - Sweden 464
    - Tunisia 464
    - Yugoslavia 464
  - European zinc cartel 464
- Tariff 466
- Imports and exports 466
  - Imports 466
  - Exports 468
- Consumption 471
  - Apparent deliveries of primary slab zinc to domestic consumers 471
  - Consumption by uses 472
- Prices and value 475

GENERAL SUMMARY

Salient figures of the zinc industry in the United States, 1929 and 1930

	1929	1930
Production of primary zinc:		
From domestic ores short tons	612, 136	489, 361
From foreign ores do	13, 311	8, 684
	625, 447	498, 045
Apparent deliveries of primary zinc to domestic consumers do	568, 525	408, 469
Estimated industrial use of primary and secondary slab zinc do	629, 300	475, 900
Stocks of zinc on hand at smelters Dec. 31 do	85, 904	167, 293
Ratio of electrolytic zinc to total primary zinc production per cent	24. 98	26. 34
Recovery of unalloyed secondary zinc short tons	65, 400	49, 300
Prices per pound of prime western zinc at St. Louis:		
Average for year cents	6. 49	4. 56
Highest monthly average do	6. 78	5. 24
Lowest monthly average do	5. 65	4. 06
Mine production of recoverable zinc short tons	724, 478	595, 425
Tri-State district (Joplin region) per cent of total	43	36
Western States do	33	33
Other do	24	31
World smelter production of zinc short tons	1, 599, 000	1, 524, 000

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[1] Work on manuscript completed November, 1931.

[2] The statistics in this report were prepared (unless otherwise indicated) by H. M. Meyer, and the data on imports and exports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

Conditions in the United States zinc industry during 1930 were far from satisfactory to producers. The slowing up in industrial activity in this country, due largely to world economic depression, resulted in a decrease of 24 per cent in the consumption of primary and secondary slab zinc. Producers failed to adjust production to the declining demand, so that there was an increase of nearly 100 per cent in producers' stocks. Prices declined rapidly, the average at St. Louis for the year being the lowest since 1901.

The St. Louis quotation for prime western zinc averaged 4.56 cents per pound in 1930, as compared with 6.49 cents in 1929, a decrease of 30 per cent. The opening quotation was 5.45 cents, the highest of the year. Except for a sharp flurry upward during July the trend was downward throughout most of the year until the lowest quotation (3.95 cents) was reached on October 15. From then on the price fluctuated somewhat and at the end of the year stood at 4.125 cents.

The production of primary zinc in the United States amounted to 498,045 tons in 1930, as compared with 625,447 tons in 1929, a decrease of 20 per cent and the lowest yearly output since 1922. Ninety-eight per cent of the 1930 total was produced from domestic ores and 2 per cent from foreign ores. The quantities derived from domestic and foreign ores decreased 20 and 35 per cent, respectively. In 1930 electrolytic zinc amounted to 26.3 per cent of the total primary output, as compared with 25 per cent in 1929, indicating that curtailment at retort smelters was more pronounced than at electrolytic zinc plants.

The apparent deliveries of primary zinc to domestic consumers decreased 28 per cent in 1930, and the industrial use of primary and secondary slab zinc as reported by the American Bureau of Metal Statistics declined 24 per cent. These figures suggest a substantial withdrawal from consumers' stocks during the year. The use of zinc in galvanized products, brass, and rolled zinc—the three principal uses—declined 25, 19, and 25 per cent, respectively. The use of zinc in die-castings, which had increased rapidly up to 1929, declined 40 per cent in 1930. The American Zinc Institute, at its annual meeting in April, 1930, decided to conduct a market survey to determine methods of increasing the sales of galvanized iron.

Mine production of zinc decreased 18 per cent in 1930, the principal decreases being in Oklahoma, Montana, Kansas, Idaho, Utah, New Jersey, and Wisconsin. There were substantial increases in New York, Colorado, Nevada, and Tennessee-Virginia. The Eastern and Southern States increased in importance in the country's total production, while the tri-State district declined in importance; the Western States produced the same proportion of the total in 1930 as in 1929.

The tariff act of 1930, which became effective June 18, 1930, contains important increases in duties on zinc ores containing less than 25 per cent zinc, high-strength lithopone, and zinc sulphide.

World smelter production in 1930 decreased 5 per cent, the largest tonnage decreases occurring in the United States, Belgium, and Great Britain. Canada, Norway, Northern Rhodesia, Poland, and Mexico showed substantial tonnage increases. There was a large increase in the world's stocks of zinc.

During the latter part of 1930 production of zinc began at the new electrolytic plant at Flin Flon, Manitoba. The production at this new plant, together with increased production from the Sullivan mine, British Columbia, accounted for Canada's increased output in 1930. Zinc production at the Sherritt-Gordon mine, Manitoba, and at Mt. Isa, Queensland, has been postponed, owing to the low price of the metal. In the Broken Hill district, New South Wales, production was maintained at a high rate until the expiration of the British Board of Trade contract in June, 1930, but subsequently zinc production was suspended at some of the mines. By the close of the year many small producing mines and many new properties being developed were shut down completely.

The London price of zinc declined from an average of 4.27 cents per pound in January to 2.98 cents in December. The average for the year was 3.60 cents, the lowest since 1895 and 0.96 cent below the St. Louis average. Negotiations looking toward renewal of the European zinc cartel continued during 1930 but had achieved no success by the close of the year. Apparently some producers favored with low costs preferred to see curtailment of production come about by the natural elimination of high-cost producers.

PRODUCTION

GENERAL

The production of slab zinc is classified by the Bureau of Mines as (1) primary or secondary, according to whether the zinc has been manufactured from primary or secondary materials; (2) domestic or foreign, a division of primary production based on whether the materials used were domestic or foreign; (3) electrolytic or distilled, based on the process of manufacture.

To determine the production of primary zinc, the Bureau of Mines makes a canvass of the zinc smelters that ordinarily operate on primary raw materials of domestic and foreign origin. Many of these smelters also include substantial amounts of secondary materials in their furnace charges, so the slab zinc produced includes both primary and secondary zinc. Although the two are inseparable, the smelter calculates the amount of zinc produced from the secondary materials and classifies it as redistilled secondary zinc. A similar calculation is made in order to separate primary zinc into zinc of domestic and foreign origin. Some smelters treat secondary materials, exclusively, in large graphite retorts; zinc so produced is also recorded as redistilled secondary.

The following table shows the quantity and value of domestic primary, foreign primary, and redistilled secondary zinc produced in the United States during the past 10 years.

Domestic and foreign primary and redistilled secondary zinc produced in the United States, 1921–1930

Year	Domestic primary		Foreign primary		Redistilled secondary		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	198, 232	$19, 823, 000	2, 268	$227, 000	17, 573	$1, 757, 000	218, 073	$21, 807, 000
1922	353, 274	40, 273, 000	1, 003	114, 000	32, 988	3, 761, 000	387, 265	44, 148, 000
1923	508, 335	69, 134, 000	2, 099	285, 000	39, 434	5, 363, 000	549, 868	74, 782, 000
1924	515, 831	67, 058, 000	1, 508	196, 000	35, 486	4, 613, 000	552, 825	71, 867, 000
1925	555, 631	84, 456, 000	17, 315	2, 632, 000	39, 181	5, 955, 000	612, 127	93, 043, 000
1926	611, 991	91, 799, 000	6, 431	964, 000	40, 799	6, 120, 000	659, 221	98, 883, 000
1927	576, 960	73, 851, 000	15, 556	1, 991, 000	42, 784	5, 476, 000	635, 300	81, 318, 000
1928	591, 525	72, 166, 000	11, 056	1, 349, 000	48, 666	5, 937, 000	651, 247	79, 452, 000
1929	612, 136	80, 802, 000	13, 311	1, 757, 000	47, 348	6, 250, 000	672, 795	88, 809, 000
1930	489, 361	46, 979, 000	8, 684	834, 000	[1] 34, 849	3, 345, 000	532, 894	51, 158, 000

[1] Includes 22 tons of secondary electrolytic zinc.

PRIMARY ZINC

The term "primary zinc," as used herein, refers only to zinc produced from ores or from the immediate by-products of primary reduction operations. Thus, zinc manufactured from smelter drosses and skimmings is designated as primary, whereas that produced from galvanizers' drosses, ashes, and scrap metal is designated as secondary. Although a large part of the latter enters the market indistinguishable from the former and becomes part of the supply of zinc available to consumers, it is nevertheless deemed advisable to retain the above classification; otherwise the long-time record of production might include metal that is constantly reworked.

The following table shows the primary zinc produced in the United States from 1921 to 1930, apportioned according to the source of the ore and the locality at which it was reduced.

Primary zinc produced in the United States, 1921–1930, in short tons

APPORTIONED ACCORDING TO SOURCE OF ORE

Year	Domestic[1]	Foreign				Total
		Australia	Canada	Mexico	Total	
1921	198,232	133	521	1,614	2,268	200,500
1922	353,274		55	948	1,003	354,277
1923	508,335			2,099	2,099	510,434
1924	515,831		1,396	112	1,508	517,339
1925	555,631		7,997	9,318	17,315	572,946
1926	611,991			6,431	6,431	618,422
1927	576,960			15,556	15,556	592,516
1928	591,525			11,056	11,056	602,581
1929	612,136			13,311	13,311	625,447
1930	489,361			8,684	8,684	498,045

APPORTIONED ACCORDING TO LOCALITY AT WHICH REDUCED

Year	Arkansas	Idaho	Illinois	Kansas	Montana	Oklahoma	Pennsylvania	Other States	Total
1921	15,278		48,865	16,573	11,559	41,244	36,378	30,603	200,500
1922	13,627		76,266	24,167	55,369	74,537	57,319	52,992	354,277
1923	29,870		93,239	32,006	71,088	119,744	82,003	82,484	510,434
1924	28,447		93,370	28,640	77,493	118,487	83,016	87,886	517,339
1925	27,145		109,672	25,765	79,004	138,906	99,899	92,555	572,946
1926	32,712		110,381	33,671	111,596	136,560	100,538	92,964	618,422
1927	26,317		102,768	33,144	112,629	120,801	106,099	90,758	592,516
1928	20.505	1,939	103,765	33,923	158,221	106,557	108,802	68,869	602,581
1929	17,923	16,582	112,425	37,795	138,019	111,683	108,167	82,853	625,447
1930	13,917	9,509	103,331	13,682	112,908	79,742	101,916	63,040	498,045

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[1] The slab zinc that was rolled is included here.

The production of primary zinc in the United States in 1930 decreased 127,402 tons, or 20.4 per cent, from 1929, as a result of decreases of 122,775 tons, or 20.1 per cent, in production from domestic ore and 4,627 tons, or 34.8 per cent, in production from foreign ores. In 1930, as in 1926 to 1929, inclusive, all the foreign ore smelted in the United States was imported from Mexico.

Montana continued to be the leading producer of metallic zinc in 1930, even though the output was 18 per cent less than in 1929 and 29 per cent less than in 1928. Illinois was again second but showed a decrease of 8 per cent in production. Pennsylvania moved from fourth to third place, although its production declined 6 per cent.

Oklahoma, which ranked first in production for several years prior to 1928, fell to fourth place in 1930 as a result of a 29 per cent decrease in output. Production in Kansas, Arkansas, and Idaho decreased materially in 1930. Other States in which primary zinc was produced in 1930 include Texas, West Virginia, and Indiana, all of which showed decreases as compared with 1929.

The production of primary zinc by the retort process decreased 21.8 per cent in 1930, while that by the electrolytic process decreased 16 per cent.

DISTILLED AND ELECTROLYTIC ZINC

As already stated, a considerable quantity of material designated as secondary zinc results from redistillation of zinc ashes and scrap; some smelters that handle ore regularly may at times smelt a mixture of secondary material and ore. Slab zinc so produced is not distinguished from primary metal when marketed. For statistical purposes, however, the amount of this secondary metal is calculated by the smelters and is recorded herein as redistilled secondary zinc. Zinc produced from secondary materials at secondary smelters using large graphite retorts is also recorded as redistilled secondary.

Slab zinc produced for market is graded according to its purity. The official classification, as given by the American Society for Testing Materials, follows. The specifications of the United States Navy and War Departments are practically the same as those of the American Society for Testing Materials. Commercially, however, zinc is graded to narrower limits, and many companies market several varieties within the range of one official classification.

Classification of various grades of zinc and the maximum impurities allowed

Maximum impurities	Navy and War Departments				
	Grade A	Grade B	Grade C	Grade D	Grade E
	American Society for Testing Materials				
	High grade	Intermediate	Brass special	Selected	Prime western
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Lead	0.07	0.20	0.60	0.80	1.60
Iron	.03	.03	.03	.04	.08
Cadmium	.07	.50	.50	.75	(1)
Aluminum	None.	None.	None.	None.	(1)
Total	.10	.50	1.00	1.25	(1)

[1] Not specified.

In segregating production into the various grades the smelters report the total production and do not differentiate between primary distilled and redistilled secondary. The following table shows the total production of electrolytic and distilled zinc, both primary and secondary, apportioned according to method of reduction and according to grade.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1921–1930, in short tons

APPORTIONED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled primary	Redistilled secondary [1]	Total
1921	11, 559	188, 941	17, 573	218, 073
1922	55, 369	298, 908	32, 988	387, 265
1923	71, 088	439, 346	39, 434	549, 868
1924	77, 493	439, 846	35, 486	552, 825
1925	79, 004	493, 942	39, 181	612, 127
1926	111, 596	506, 826	40, 799	659, 221
1927	112, 629	479, 887	42, 784	635, 300
1928	160, 160	442, 421	48, 666	651, 247
1929	156, 235	469, 212	47, 348	672, 795
1930	131, 166	366, 879	[2] 34, 849	532, 894

APPORTIONED ACCORDING TO GRADE

Year	Grade A (high grade)	Grade B (intermediate)	Grade C (brass special)	Grade D (selected)	Grade E (prime western)	Total
1921	24, 084	4, 996	47, 814		141, 179	218, 073
1922	67, 459	36, 402	49, 980		233, 424	387, 265
1923	89, 739	58, 513	90, 459		311, 157	549, 868
1924	108, 238	48, 874	100, 290		295, 423	552, 825
1925	111, 964	49, 198	81, 176		369, 789	612, 127
1926	143, 224	48, 169	84, 689		383, 139	659, 221
1927	150, 933	40, 121	72, 104		372, 142	635, 300
1928	197, 675	41, 779	73, 957		337, 836	651, 247
1929	207, 321	27, 430	96, 163		341, 881	672, 795
1930	156, 494	26, 079	93, 270		257, 051	532, 894

[1] For total production of secondary zinc see p. 441.
[2] Includes 22 tons of secondary electrolytic zinc.

The table shows a decrease of 16 per cent in electrolytic zinc production in 1930, compared with a decrease of 2.5 per cent in 1929. In 1930 there was a decrease of 21.8 per cent in the production of primary distilled zinc, compared with an increase of 6.1 per cent in 1929. Recovery of redistilled secondary zinc decreased 26 per cent in 1930; 43 per cent of the total was produced at primary smelters and 57 per cent at secondary smelters. The quantity produced at primary smelters declined 22 per cent, whereas that produced at secondary smelters decreased 29 per cent. Production of all grades of zinc decreased in 1930, but the decline was chiefly in "high grade" and "prime western."

HIGH GRADE

The production of high-grade metal, formerly used chiefly in the manufacture of die-casting alloys and special brasses, has so expanded as a result of the increased application of the electrolytic process that the supply far exceeds ordinary demands, and much of it is now being used in the manufacture of ordinary brass. The result has been a reduction in the premium paid for high-grade zinc. In 1914, when no electrolytic zinc was produced, the production of high-grade metal amounted to 5 per cent of the total output, and a premium of 3 cents a pound was paid. During the World War the premium increased to several times that amount, but in recent years it has decreased steadily. In 1930, 29.4 per cent of the total zinc produced was high grade; and, according to the prices quoted in the American Metal Market, the monthly average premium fluctuated between 1.244 cents and 1.000 cent a pound, averaging 1.021 cents for the year.

INTERMEDIATE

Practically all zinc of intermediate grade is used in the manufacture of specialty alloys and brasses; it is becoming less important. In 1923 production amounted to nearly 59,000 tons, but in 1930 it decreased to 26,079 tons. This grade of zinc commands a premium of about one-half cent a pound over prime western.

BRASS SPECIAL

Brass special, as its name suggests, is used largely in the manufacture of brass. The production of this grade of zinc, including a small tonnage of selected grade, decreased from 100,000 tons in 1924 to 74,000 tons in 1928 but increased to 96,000 tons in 1929, a level that was nearly maintained in 1930. The 1929 increase was due to the fact that some producers who were forced to discontinue the production of intermediate zinc due to changed market conditions began producing brass special largely. The premium on brass special in 1930 ranged from 0.05 to 0.10 and averaged 0.076 cent per pound over prime western.

SELECTED

Only a relatively small quantity of the selected grade of zinc is produced, and the tonnage is included with the production of brass special. It is used chiefly in the manufacture of cheaper brasses where uniformity of composition is necessary, such as in brass rod stock for machine-made screws, bolts, tire valves, etc. The narrower limits of composition of this grade of zinc permit closer control on the machining properties of the brass product than could be obtained with prime western zinc. The premium on this grade is about 5 cents per 100 pounds.

PRIME WESTERN

Prime western zinc is the most common grade and is the principal product of retort smelters. In 1925 this grade amounted to 60 per cent of the total output but in 1930 had decreased to 48 per cent. It is estimated that approximately three-fourths of the production of this grade of zinc is used in the zinc-coating (galvanizing) industry. Prime western zinc is also used in the manufacture of cheaper grades of brass.

ROLLED ZINC

The accompanying tables show the quantity and value of rolled zinc produced in the United States from 1921 to 1930. The total production in 1930 amounted to 51,385 tons, or 25 per cent less than in 1929 and 40 per cent less than in 1926. The largest part of the decrease during the last four years may be attributed to the decline in the manufacture of dry cells that has resulted from the widespread adoption of "socket-power" radio receivers. According to the American Bureau of Metal Statistics the consumption of rolled zinc in the manufacture of dry batteries decreased from 28,350 tons in 1926 to 11,640 tons in 1930, a drop of 59 per cent. The total value of the rolled zinc produced was 28 per cent less in 1930 than in 1929 and 52 per cent less than in 1926.

Imports of sheet zinc into the United States since 1923 have been negligible. Exports in 1930 decreased 27 per cent from 1929 and amounted to 8 per cent of the total United States production.

Zinc rolled in the United States, 1921–1930

Year	Pounds	Value		Year	Pounds	Value	
		Total	Average			Total	Average
1921	60,800,186	$5,940,208	$0.098	1926	172,668,298	$17,880,901	$0.104
1922	107,018,050	8,546,109	.080	1927	148,259,718	13,671,530	.092
1923	111,666,474	10,164,981	.091	1928	147,961,670	12,364,908	.084
1924	122,084,719	11,552,354	.095	1929	136,667,203	12,105,177	.089
1925	142,253,945	14,514,234	.102	1930	102,769,995	8,671,408	.084

Rolled zinc available for consumption in the United States, 1929 and 1930

	1929			1930		
	Pounds	Value		Pounds	Value	
		Total	Average		Total	Average
Sheet zinc not over 0.1 inch thick	48,715,207	$4,590,772	$0.094	37,512,635	$3,376,194	$0.090
Boiler plate and sheets over 0.1 inch thick	2,262,341	198,823	.088	1,771,412	148,608	.084
Strip and ribbon zinc	85,689,655	7,315,582	.085	63,485,948	5,146,606	.081
Total zinc rolled	136,667,203	12,105,177	.089	102,769,995	8,671,408	.084
Sheet zinc imported for consumption	440	52		130,870	6,420	
Rolled zinc exported	10,529,333	1,075,000	.102	7,735,247	761,007	.098
Available for consumption	126,138,310			95,165,618		
Slab zinc, grades B, C, and D			.065			.047
Spread			.024			.037

The quoted base price of sheet zinc, carload lots, f. o. b. rolling mills, ranged from 9.5 to 10.5 cents per pound during 1930. These quotations, however, are subject to discounts which may fluctuate, whereas the base quotations remain steady. The average price actually received by rolling mills reporting to the Bureau of Mines was 8.4 cents for all classes of rolled zinc, compared with 8.9 cents in 1929, a drop of 6 per cent. The average price of the grades of slab zinc used in rolling mills decreased to 4.7 cents in 1930, so that the value added by rolling amounted to 3.7 cents per pound in 1930, compared with 2.4 cents in 1929 and 2.3 cents in 1928.

The following companies reported production of rolled zinc in the United States in 1930.

Producers of rolled zinc in the United States in 1930

	Location of plant
American Zinc Products Co.	Greencastle, Ind.
Atlantic Zinc Works (Inc.)	Brooklyn, N. Y.
Ball Bros. Co.	Muncie, Ind.
Edes Manufacturing Co.	Plymouth, Mass.
Hazel-Atlas Glass Co.	Wheeling, W. Va.
Hegeler Zinc Co.	Danville, Ill.
Illinois Zinc Co.	Peru, Ill.
Matthiessen & Hegeler Zinc Co.	La Salle, Ill.
New Jersey Zinc Co.	Palmerton, Pa.
The Platt Bros. & Co.	Waterbury, Conn.

ZINC DUST

The commercial production of zinc dust in the United States began in 1910 and reached a maximum in 1920, when it amounted to approximately 11,500 tons. From 1922 to 1927 the annual production averaged about 8,000 tons. In 1930, 9,237 tons were produced, a decrease of 16 per cent from 1929.

Zinc dust varies in composition but on the average contains about 90 per cent of metallic zinc and 10 per cent of zinc oxide, the latter occurring as a film on the surface of the metallic particles. Before 1926 two varieties of zinc dust—"blue powder" and "atomized"—were marketed; the former was produced by the distillation of zinc and the latter by ejecting molten metal from the nozzle under pressure. No atomized zinc dust was sold in 1926 or 1927, but in 1928 production of the commodity for market was resumed. The Anaconda Copper Mining Co., the Sullivan Mining Co., and the Evans-Wallower Zinc Co. produce some atomized zinc dust, but as their entire product is used as a purifying agent in their electrolytic zinc plants and eventually enters the market as slab zinc it is not included in the figures given in the following table.

Zinc dust sold by producers in the United States, 1921–1930

Year	Prepared "blue powder"			Zinc dust "atomized"			Primary zinc recovered as zinc dust (short tons)[1]
	Short tons	Value		Short tons	Value		
		Total	Average per pound		Total	Average per pound	
1921	2,006	$333,390	$0.083	999	$152,151	$0.076	1,380
1922	3,394	531,225	.078	3,859	573,220	.074	2,113
1923	3,676	643,766	.088	4,376	702,923	.080	2,450
1924	3,894	620,078	.080	4,063	621,221	.076	1,861
1925	[2] 8,314	[2] 1,500,758	[2] .090	(2)	(2)	(2)	2,251
1926	7,994	1,490,293	.093				2,794
1927	8,098	1,345,105	.083				3,249
1928	[2] 9,172	[2] 1,475,875	[2] .080	(2)	(2)	(2)	2,668
1929	[2] 11,050	[2] 1,864,672	[2] .084	(2)	(2)	(2)	3,263
1930	[2] 9,237	[2] 1,205,740	[2] .065	(2)	(2)	(2)	2,559

[1] The amount of secondary zinc recovered in zinc dust, 1927–1930, is shown in the table on secondary zinc, p. 441.

[2] Figures for "atomized" included under "blue powder." Bureau of Mines not at liberty to publish figures separately.

One of the chief uses of zinc dust is in the sherardizing process, wherein metal articles are given a zinc coating by heating with zinc dust in a sealed container. It is said that the zinc vaporizes at a temperature below its melting point and that the vapor forms an alloy on the surface of the metals to be coated. The process is especially adapted to the coating of quantities of small articles and threaded hardware, such as screws, bolts, and nuts. Zinc dust is also used as a reducing agent in the manufacture of dyes; as a precipitant of gold in the cyanide process; and as a pigment in paints, especially marine paints.

The following companies reported the production and sale of zinc dust in 1930.

Producers of zinc dust in the United States in 1930

	Location of plant
The Alloys Co.	San Francisco, Calif.
American Smelting & Refining Co.	Sand Springs, Okla.
Federated Metals Corporation	Trenton, N. J.
John Finn Metals Works	San Francisco, Calif.
Grasselli Chemical Co.	Meadowbrook, W. Va.
New Jersey Zinc Co.	Palmerton, Pa.
Superior Zinc Corporation	Philadelphia, Pa.

ZINC PIGMENTS AND SALTS

Zinc oxide, leaded zinc oxide, and lithopone are the principal pigments of zinc, and the chloride and sulphate are the principal salts. These products are manufactured from various zinciferous materials, such as ores, metal, and secondary substances. In 1930 the total zinc content of all zinc pigments and salts produced in the United States amounted to 153,955 tons, a decrease of 25 per cent from that in 1929. This was derived from the following sources:

Zinc content of zinc pigments and salts made in the United States, 1929 and 1930, by sources, in short tons

Source	1929	1930
Domestic ore	[1] 138, 104	104, 561
Metal	39, 620	27, 090
Secondary material	[1] 26, 795	22, 304
	[1] 204, 519	153, 955

[1] Revised figures.

The following table gives the primary zinc content (that is, zinc derived directly from ores) of zinc pigments and salts produced for market in the United States during the past 10 years.

Primary zinc content of zinc pigments and salts made in the United States, 1921–1930, in short tons [1]

Year	Pigments	Salts	Year	Pigments	Salts
1921	53, 480	3, 749	1926	127, 685	[2] 3, 230
1922	93, 112	1, 801	1927	121, 899	[2] 867
1923	115, 970	1, 573	1928	123, 964	[2] 806
1924	108, 282	1, 075	1929	137, 147	[2] 957
1925	110, 554	[2] 1, 010	1930	103, 298	1, 263

[1] Includes some zinc derived from primary drosses from zinc-reduction plants.
[2] Revised figures.

The use of zinc ore, metallic zinc, and secondary material in the manufacture of pigments and salts decreased 24, 32, and 17 per cent, respectively, in 1930.

Ore was used in the manufacture of the following pigments and salts in 1930, the percentages representing the proportion of the total recoverable zinc content of the ore used in each product:

	Per cent
American process zinc oxide	68
Lithopone	20
Leaded zinc oxide	11
Zinc salts	1

The metallic zinc was practically all used in the manufacture of French process zinc oxide.

The secondary zinc was distributed as follows:

	Per cent
Lithopone	66
Zinc salts	33
Zinc oxide and leaded zinc oxide	1

Further details of the production of zinc pigments and salts are given in the Mineral Resources chapter on Lead and Zinc Pigments and Salts.

SECONDARY ZINC

Secondary zinc production as reported by the Bureau of Mines includes zinc recovered from industrial scrap and junk, except that zinc recovered in the same plant in which the industrial scrap is made is excluded. The accompanying table, compiled by J. P. Dunlop, of the Bureau of Mines, shows the quantity of secondary zinc recovered in the United States as metal and in zinc dust, zinc pigments, and zinc salts, 1927 to 1930.

Secondary zinc recovered in the United States, 1927–1930, in short tons

	1927	1928	1929	1930
Secondary zinc, redistilled	42, 784	48, 666	47, 348	[1] 34, 849
Secondary zinc, remelted	22, 016	22, 034	18, 052	14, 451
Total secondary zinc recovered unalloyed	64, 800	70, 700	65, 400	49, 300
Recovered zinc in alloys, excluding old brass remelted	12, 400	12, 500	11, 600	7, 700
Recovered zinc in remelted brass (estimated)	63, 200	66, 000	65, 670	42, 300
Total secondary zinc recovered as metal	140, 400	149, 200	142, 670	99, 300
Secondary zinc recovered in zinc dust	4, 400	5, 600	6, 700	5, 800
Secondary zinc recovered in pigments	14, 000	14, 900	16, 000	15, 000
Secondary zinc recovered in zinc salts	9, 544	10, 500	[2] 10, 800	7, 300
Total secondary zinc recovered	168, 300	180, 200	[2] 176, 200	127, 400

[1] Includes 22 tons of secondary electrolytic zinc.

[2] Revised figures.

The recovery of secondary zinc decreased 28 per cent in 1930, the lowest output since 1921, while the production of primary zinc decreased 20 per cent.

Secondary zinc recovered in the form of metal decreased 30 per cent, due to decreases of 26 per cent in redistilled secondary zinc, 20 per cent in remelted zinc, 34 per cent in alloys other than old brass, and 36 per cent in remelted brass; that recovered in dust, pigments, and salts decreased 16 per cent.

Since 1910, the first year for which satisfactory data are available, production of secondary zinc has shown a remarkable increase, but as the production of primary zinc has increased at about the same rate there has been little change in the ratio of secondary to primary zinc. From 1910 to 1914 the recovery of secondary zinc as metal was equivalent to 23 per cent of the total primary zinc output. During the war and postwar periods the ratio was upset by extraordinary conditions, but during the past seven years it again averaged 23 per cent. In 1930 the ratio was 20 per cent. The corresponding ratio for copper was 43 per cent; that for lead was 40 per cent. This relatively advantageous position of zinc is probably due to the large percentage consumed in dissipative uses, such as zinc coatings, zinc dust, pigments, and salts which yield little secondary metal. It is estimated that less than 35 per cent of all the zinc mined each year is ever available for secondary usage.

BY-PRODUCT SULPHURIC ACID

An important by-product of zinc-smelting operations is the sulphuric acid made from the sulphur gases evolved in roasting zinc sulphide ores preparatory to their reduction to metal or conversion to zinc oxide or to zinc salts. Sulphur gases from zinc ores were first utilized thus in the United States in 1882 by Matthiessen & Hegeler at La Salle, Ill.; but now these gases are used at numerous acid plants, which may be at zinc smelters and zinc oxide plants, at roasting and magnetic separating plants, at the mines, or nearer the acid markets, the roasted concentrates being shipped to the smelters or to other zinc plants.

For several years the demand for sulphuric acid has been strong, and to utilize their acid-plant capacities producers have been forced to burn large quantities of sulphur to supplement the gases derived from the roasting of zinc blende; thus, the acid production recorded as a by-product of zinc smelting has been derived from two sources—zinc ores and sulphur.

The following table gives the total quantity and value of sulphuric acid of different strengths produced and sold by plants associated with zinc-blende roasting operations.

By-product sulphuric acid produced at zinc-blende roasting plants in the United States, 1927–1930

	1927	1928	1929	1930
Number of establishments	22	21	21	21
Acid reported as 50°-60° B.:				
Produced (expressed as 60° B.)...short tons..	605, 086	643, 407	694, 990	548, 660
Consumed at works (expressed as 60° B.)...do...	34, 586	32, 680	33, 474	28, 206
Sold (expressed as 60° B.)...do...	572, 347	618, 010	657, 785	518, 665
Value of acid sold—				
Total	$5, 588, 204	$6, 109, 459	$6, 336, 444	$4, 996, 275
Average	$9. 76	$9. 89	$9. 63	$9. 63
Acid reported as 66° B. and stronger:				
Produced (expressed as 66° B.)...short tons..	401, 290	384, 445	482, 507	385, 038
Consumed at works (expressed as 66° B.)...do...	48, 637	34, 742	67, 670	51, 314
Sold (expressed as 66° B.)...do...	334, 470	365, 596	441, 617	352, 886
Value of acid sold—				
Total	$4, 752, 736	$5, 077, 475	$6, 381, 556	$4, 867, 536
Average	$14. 21	$13. 89	$14. 45	$13. 79
Total acid sold, equivalent in 60° B.:				
Quantity...short tons..	973, 711	1, 056, 725	1, 187, 726	942, 128
Value	$10, 340, 940	$11, 186, 934	$12, 718, 000	$9, 863, 811
Total acid consumed at works (60° B.)...short tons.	92, 950	74, 370	114, 678	89, 783

The total production of sulphuric acid (60° B.) at zinc-blende roasting plants in 1930 amounted to 1,010, 706 tons, a decrease of 21 per cent from that in 1929 and about 16 per cent of the total output of sulphuric acid in the United States.

The quantity of acid sold by zinc plants in 1930 was 21 per cent less than in 1929. The average price received for 60° B. acid was the same as in 1929. The average sales price of 66° B. and stronger acids decreased 5 per cent in 1930. The total value of all sales decreased 22 per cent in 1930. Sales of 60° B. acid decreased 21 per cent, while production fell off in the same proportion. Sales of 66° B. acid decreased 20 per cent, while production declined in the same ratio.

Statistics indicate that producers' stocks of 60° B. acid remained constant and those of 66° B. acid decreased slightly in 1930.

The following statement shows the quantity of blende and sulphur used and the quantity and value of the acid made from each.

Production and value of sulphuric acid made from blende and sulphur at zinc-blende roasting plants in the United States, 1929 and 1930

	1929	1930
Number of establishments	21	21
Blende used short tons	682, 666	565, 092
Acid made, equivalent in 60° B do	627, 018	536, 614
Value at average of sales of 60° B	$6, 038, 183	$5, 167, 593
Sulphur used short tons	176, 525	125, 740
Acid made, equivalent in 60° B do	646, 980	474, 092
Value at average of sales of 60° B	$6, 230, 417	$4, 565, 506
Total quantity of acid made (60° B.) short tons	1, 273, 998	1, 010, 706
Total value of acid made	$12, 268, 600	$9, 733, 099

In 1930, 53 per cent of the acid made at zinc plants was derived from blende and 47 per cent from sulphur, compared with 49 and 51 per cent, respectively, in 1929. Seventeen per cent less blende was used and 14 per cent less acid was made from blende in 1930 than in 1929. Acid made from blende in 1930 was 9 per cent of the total production of the United States. The quantity of sulphur used at zinc plants decreased 29 per cent in 1930, and the acid produced therefrom decreased 27 per cent.

A list of operators in 1930, with the location of their acid plants, follows. Plants at zinc smelters are also indicated in the list of zinc-reduction plants on page 445. The American Zinc Oxide Co., of Columbus, Ohio, has a zinc-roasting plant and disposes of the sulphur gases to the neighboring plant of the Farmers Fertilizer Co.

Producers of by-product sulphuric acid at zinc-blende roasting plants in the United States in 1930

	Location of plant
American Steel & Wire Co	Donora, Pa.
American Zinc & Chemical Co	Langeloth, Pa.
American Zinc Co. of Illinois	East St. Louis, Ill.
Do	Hillsboro, Ill.
American Zinc Oxide Co	Columbus, Ohio.
Eagle-Picher Lead Co	Hillsboro, Ill.
Grasselli Chemical Co	Grasselli, Ind.
Do	Canton, Ohio.
Do	Cleveland, Ohio.
Do	Lockland, Ohio.
Do	Niles, Ohio.
Do	New Castle, Pa.
Hegeler Zinc Co	Danville, Ill.
Illinois Zinc Co	Peru, Ill.
Matthiessen & Hegeler Zinc Co	La Salle, Ill.
Mineral Point Zinc Co	Depue, Ill.
Monsanto Chemical Co	East St. Louis, Ill.
National Zinc Co	Bartlesville, Okla.
National Zinc Separating Co.[3]	Platteville, Wis.
New Jersey Zinc Co. (of Pennsylvania)	Palmerton, Pa.
United Zinc Smelting Corporation	Moundsville, W. Va.

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[3] Acid made chiefly from partly desulphurized pyrite tailings from magnetic separating plant.

MINE PRODUCTION

The following table shows the mine production of zinc in the United States, by States, during the past 10 years.

Mine production of recoverable zinc in the United States, 1921–1930, in short tons

State	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Arizona		105	260	....	3,606	6,473	1,134	639	1,229	815
Arkansas	15	134	148	4	43	87	128	86	9	....
California	423	1,506	....	1,530	5,745	10,217	4,031	....	....	....
Colorado	1,180	11,629	27,076	28,364	30,811	32,500	35,865	35,731	29,431	36,259
Idaho	17	2,055	13,976	7,670	15,619	26,307	26,778	31,293	45,675	37,649
Illinois	2,426	3,124	1,266	2,512	2,724	2,577	521	17	31	9
Kansas	36,994	56,225	100,969	105,392	118,778	126,307	109,427	107,221	109,850	74,304
Kentucky	220	142	270	492	429	1,838	860	92	....	....
Missouri	10,845	16,171	18,265	12,920	14,794	26,018	18,737	12,974	11,017	10,811
Montana	11,638	59,535	70,730	64,238	57,658	73,701	80,231	82,830	68,176	26,421
Nevada	35	1,309	7,083	5,501	7,411	5,409	3,172	3,398	8,460	14,584
New Jersey	56,447	73,657	75,227	84,370	89,261	80,629	95,695	99,871	103,740	97,626
New Mexico	114	2,248	8,248	10,380	9,246	12,052	29,802	31,203	34,455	32,765
New York	1,572	4,816	8,463	4,664	5,158	5,041	3,750	11,257	10,250	22,471
Oklahoma	121,372	209,682	242,421	269,137	283,371	272,567	206,611	180,252	192,042	136,153
Oregon	....	....	....	....	....	....	....	....	....	6
Tennessee	9,692	15,568	15,900	14,376	16,256	12,098	10,400	[1] 32,917	[1] 40,558	[1] 48,147
Utah	35	2,560	5,665	9,281	26,306	47,590	49,593	46,929	51,510	44,495
Virginia	....	....	....	2,664	2,732	5,830	8,325	(1)	(1)	(1)
Washington	225	614	1,512	455	669	522	640	43	1,059	352
Wisconsin	3,390	10,952	13,211	14,027	20,230	26,800	32,841	18,417	16,986	12,558
	256,640	472,032	610,690	637,977	710,847	774,563	718,541	695,170	724,478	595,425

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[1] Bureau of Mines not at liberty to publish figures for Virginia for 1928, 1929, and 1930. These figures are included in the total for Tennessee.

The mine production of zinc in the United States in 1930 amounted to 595,425 tons, a decrease of 18 per cent from 1929. Production in the Eastern and Southern States increased 9 per cent, while that in the Mississippi Valley States and the Western States decreased 29 and 19 per cent, respectively. The Mississippi Valley States produced 39 per cent of the 1930 total, Western States 33 per cent, and Eastern and Southern States 28 per cent. In 1929 the proportions were 46, 33, and 21 per cent, respectively.

The tri-State district (Joplin region) output decreased 30 per cent in 1930 and amounted to 93 per cent of the total for the Mississippi Valley States and 36 per cent of the total for the country. The 1930 output of this district amounted to only 51 per cent of the 1926 output and was the lowest since 1921.

The four principal producing States furnished the following percentages of the country's total in 1930: Oklahoma 23 per cent, New Jersey 16 per cent, Kansas 12 per cent, and Utah 7 per cent. Large tonnage decreases occurred in Oklahoma, Montana, Kansas, Idaho, Utah, New Jersey, and Wisconsin. Production increased in New York, Colorado, Nevada, and Tennessee-Virginia.

Detailed information concerning the mining activities in the various districts of the United States can be found in the chapters of this series dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

FLOTATION CONCENTRATES

The widespread adoption of selective flotation in the United States since 1921 is well illustrated in the following table, which shows the production of zinc flotation concentrates, exclusive of the tri-State district, from 1921 to 1930.

Zinc flotation concentrates produced in the United States, exclusive of the tri-State district, 1921–1930 [1]

Year	Concentrates (short tons)	Zinc content		Lead content	
		Short tons	Tenor, per cent	Short tons	Tenor, per cent
1921	38,433	15,311	39.84	4,457	11.60
1922	82,121	37,116	45.20	6,105	7.43
1923	169,496	83,778	49.42	11,181	6.60
1924	227,955	109,005	47.82	14,368	6.30
1925	253,989	130,594	51.42	11,064	4.36
1926	404,485	208,834	51.63	16,722	4.13
1927	500,932	265,807	53.06	12,316	2.46
1928	559,626	298,638	53.36	17,441	3.12
1929	564,274	306,906	54.39	15,303	2.71
1930	519,476	282,888	54.46	11,047	2.13

[1] Year Book, American Bureau of Metal Statistics, 1930.

ZINC-REDUCTION PLANTS

ZINC SMELTERS

The number of retorts at zinc smelters active in 1930 was 1 per cent more than in 1929, but the output of smelted primary zinc was 22 per cent less. Some time during the year 21 smelters containing 107,017 retorts were active, whereas in 1929 there were 21 active plants with 105,825 retorts. In May, 1930, the St. Joseph Lead Co. began construction of a zinc smelter near Monaca, Pa., which will treat 120 tons of zinc concentrates per day from the company's New York mines and produce metallic zinc, zinc oxide, and by-product sulphuric acid; a new electrothermic process of smelting will be employed. Production of zinc oxide and sulphuric acid began in January, 1931. The Cherryvale plant of the Edgar Zinc Co. and the Fort Smith plant of the Athletic Mining & Smelting Co. were closed during a part of 1930. The Weir Smelting Co. shut down in 1930 due to bankruptcy.

At the end of the year 15 smelters were in operation, using 34,558 retorts, or about 47 per cent of the available retorts in these plants. On December 31, 1929, 62,722 retorts, or 62 per cent of the available retorts at producing plants, were in use.

The following table shows the zinc-smelting plants operating in the United States in 1930:

Zinc-smelting plants operating in the United States in 1930

Operating company (A=acid plant located at the smelter)	Location of plant	Retorts
ARKANSAS		
Athletic Mining & Smelting Co	Fort Smith	3,328
ILLINOIS		
American Zinc Co. of Illinois (A)	East St. Louis	5,760
Hegeler Zinc Co. (A)	Danville	5,400
Illinois Zinc Co. (A)	Peru	4,400
Matthiessen & Hegeler Zinc Co. (A)	La Salle	6,276
Mineral Point Zinc Co. (A)	Depue	8,309
Missouri Zinc Co	Beckemeyer	[1] 1,032

[1] Treats secondary materials only in retorts similar to those of the primary smelters.

Zinc-smelting plants operating in the United States in 1930—Continued

Operating company (A = acid plant located at the smelter)	Location of plant	Retorts
INDIANA		
Grasselli Chemical Co	Terre Haute	4, 200
KANSAS		
Edgar Zinc Co	Cherryvale	5, 160
Weir Smelting Co	Caney	1, 920
OKLAHOMA		
Blackwell Zinc Co. (Inc.)	Blackwell	9, 600
Eagle-Picher Mining & Smelting Co	Henryetta	4, 800
National Zinc Co. (Inc.) (A)	Bartlesville	4, 256
George E. Nicholson	Kusa	3, 760
Quinton Spelter Co	Quinton	3, 360
PENNSYLVANIA		
American Steel & Wire Co. (A)	Donora	7, 904
American Zinc & Chemical Co. (A)	Langeloth	4, 864
New Jersey Zinc Co. (of Pennsylvania) (A)	Palmerton	7, 200
TEXAS		
American Smelting & Refining Co	Amarillo	6, 400
WEST VIRGINIA		
Grasselli Chemical Co	Meadowbrook	6, 720
United Zinc Smelting Corporation (A)	Moundsville	2, 368
		107, 017

In addition to these smelters the following operators treated secondary materials in large graphite retorts in 1930:

Birmingham Smelting & Refining Co., Birmingham, Ala.
General Smelting Co., Philadelphia, Pa.
Superior Zinc Corporation, Philadelphia, Pa.
Tottenville Copper Co., Tottenville, N. Y.
Trenton Smelting & Refining Branch of Federated Metals Corporation, Trenton, N. J.
Wheeling Steel Corporation, Wheeling, W. Va.

ELECTROLYTIC PLANTS

Two processes for making electrolytic zinc have been developed commercially in the United States. The first was developed by the Anaconda Copper Mining Co., the first large installation being made at Great Falls, Mont., in 1916. The second process, known as the Tainton, was first used commercially in the Sullivan plant in Idaho.

Both processes follow the same general procedure. Zinc-bearing material is subjected to a roast, which converts the zinc minerals to the soluble oxide and sulphate. The calcine is treated with sulphuric acid solution, which dissolves out the zinc content. The zinc-bearing solution is then purified and the zinc precipitated electrolytically.

The essential differences in the two processes are in the strength of acid used in the leach and the current density at which electrodeposition is carried on. The Tainton process uses stronger acid and a higher current density than the Anaconda. Both processes were described briefly in the 1928 chapter of this series.

Operations were greatly curtailed at electrolytic zinc plants in 1930. Of a total of 2,232 cells available, only 939 were operating at the end of the year, indicating production at 42 per cent of capacity.

The following table summarizes data on the electrolytic zinc plants in the United States.

Electrolytic zinc plants in operation in the United States in 1930

Company	Location	Year completed	Number of cells	Estimated annual capacity in short tons of cathode zinc [1]
Anaconda Copper Mining Co	Great Falls, Mont	1916 and later enlarged	1,176	126,000
Do	Anaconda, Mont	1928	576	63,000
Sullivan Mining Co	Kellogg, Idaho	1928	300	23,400
Evans-Wallower Zinc Co	East St. Louis, Ill	1929	180	19,000

[1] Year Book, American Bureau of Metal Statistics, 1930.

WORLD ASPECTS

WORLD MINE PRODUCTION

Compilation of the world mine production of zinc is at best a difficult task, owing to complete lack of published data for some countries and to lack of uniformity in reports from the countries that do publish production data. The following table, compiled from official and semiofficial sources, is submitted as a partial record of the world mine production during the past five years. Supplementary data, based in part on estimates, are given in the yearbooks of the American Bureau of Metal Statistics and the Metallgesellschaft.

World mine production of zinc, 1926–1930, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
North America:					
Canada [2]	68,010	75,067	83,754	89,478	121,400
Mexico	105,367	137,724	161,747	174,050	124,106
Newfoundland			7,000	34,000	39,000
United States [3]	702,668	651,846	630,644	657,232	540,158
	876,045	864,637	883,145	954,760	824,664
South America:					
Bolivia (exports)	7,601	5,637	2,261	1,395	6,028
Chile	453	1,003	499	38	1
Peru	22,975	21,589	28,587	23,686	(4)
	31,029	28,229	31,347	25,119	(4)
Europe:					
Austria	2,248	3,502	3,156	3,960	3,557
Belgium	6,000	7,000	[5] 6,000	[5] 5,000	[5] 4,000
Bulgaria [6]	(6)	(6)	(6)	(6)	(6)
Czechoslovakia	268	848	528	8	642
Finland	638	1,189	660	380	224
France	5,737	8,600	9,300	9,600	7,400
Germany	104,424	141,629	144,386	142,467	145,000
Great Britain	854	1,272	720	864	657
Greece	6,005	6,110	4,476	5,855	5,500

[1] Figures represent estimated content of ores or concentrates produced, except as otherwise noted.
[2] Smelter production plus estimated content of ores and concentrates exported.
[3] Production of recoverable zinc.
[4] Data not available.
[5] Approximate production.
[6] Production of ore reported as follows: 1926, 425 tons of zinc ore; 1927, 1,495 tons of zinc ore and 6,720 tons of lead-zinc ore; 1928, 14,762 tons of lead-zinc ore; 1929, 1,365 tons of zinc ore and 10,846 tons of lead-zinc ore; 1930, 2,762 tons of lead-zinc ore. No data available on zinc content.

World mine production of zinc, 1926–1930, in metric tons—Continued

Country	1926	1927	1928	1929	1930
Europe—Continued.					
Hungary [7]	------	(7)	(7)	(7)	(4)
Italy	71,703	87,593	84,840	86,940	79,528
Norway	32	108	22	1,446	5,586
Poland	148,900	125,700	114,600	140,000	148,000
Portugal	212	153	------	------	(4)
Russia [8]	[9] 1,900	[9] 2,500	[9] 2,300	[9] 4,400	[5] [9] 4,000
Spain	58,829	47,037	44,906	50,000	50,000
Svalbard	90	15			
Sweden	21,307	24,372	14,172	29,992	29,973
Yugoslavia	173	325	545	340	[5] 300
	[9] 432,320	[9] 455,373	[9] 430,311	[9] 482,161	[9] 484,367
Asia:					
China	12,000	[5] 10,000	[5] 5,000	[5] 5,000	[5] 5,000
Chosen [10]	(10)	(10)	(10)	(10)	(10)
India, British [11]	23,048	27,508	32,901	30,760	30,678
Indo-China	25,053	21,800	21,486	18,760	15,900
Japan [5]	12,000	10,000	10,000	10,000	10,000
Russia [8]	(9)	(9)	(9)	(9)	(9)
Turkey	------	------	2,000	4,000	5,000
	[9] 72,101	[9] 69,308	[9] 71,387	[9] 68,520	[9] 66,578
Africa:					
Algeria	28,032	21,513	15,098	14,943	8,000
Egypt	------	306	------	587	400
Kenya Colony	------	(12)	------	------	------
Morocco, French (exports)	34	71	200	989	150
Nigeria	------	10	61	------	12
Rhodesia—					
Northern Rhodesia	149	------	13,387	22,587	20,377
Southern Rhodesia	------	------	165	------	------
Tunisia	10,000	7,800	3,500	4,000	700
	38,215	29,700	32,411	43,106	29,639
Oceania:					
Australia	153,298	174,283	150,236	157,043	121,533
New Caledonia	638	450	------	420	700
	153,936	174,733	150,236	157,463	122,233
	1,604,000	1,622,000	1,599,000	1,731,000	1,558,000

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[4] Data not available.

[5] Approximate production.

[7] Production of zinc-lead ore reported as follows: 1927, 400 tons; 1928, 1,000 tons; 1929, 600 tons. No data available on zinc content.

[8] Year ended Sept. 30.

[9] Output from Russia in Asia is included under Russia in Europe.

[10] Production of zinc ore reported as follows: 1926, 7,107 tons; 1927, 3,684 tons; 1928, 5,322 tons; 1929, 5,109 tons; 1930, 3,831 tons. No data available on zinc content.

[11] Estimated zinc content of concentrates produced by the Burma Corporation (Ltd.) in Burma.

[12] Production of 12 tons of zinc ore reported, zinc content not stated.

WORLD SMELTER PRODUCTION

The following table shows the world smelter production of zinc from 1926 to 1930 as far as statistics are available. Official figures are used wherever possible. For countries for which official data are not yet available the figures are taken from the Year Book of the American Bureau of Metal Statistics and other reliable sources, but the official statistics will be substituted as received.

There is always possibility of duplication in figures showing European production, as some countries send crude zinc of poor quality to other countries for refining. Furthermore, secondary zinc probably is included in figures of production reported by some foreign countries. The figures for such countries are therefore not fully comparable with the figures for production of primary zinc in the United States, as given in the following table:

World smelter production of zinc, 1926–1930, in metric tons, by countries where smelted

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1926	1927	1928	1929	1930
Australia	48, 116	49, 944	51, 029	52, 705	55, 782
Belgium	188, 767	199, 090	206, 300	197, 900	175, 000
Canada	55, 998	66, 413	74, 176	78, 061	110, 219
China	300	(1)	(1)	(1)	(1)
Czechoslovakia	2, 789	6, 324	8, 039	10, 675	13, 472
France	64, 188	79, 583	92, 463	87, 330	90, 700
Germany [2]	68, 300	84, 100	98, 100	102, 000	97, 300
Great Britain	18, 278	42, 541	56, 284	59, 234	49, 378
Indo-China	1, 858	1, 170	2, 887	3, 808	3, 857
Italy	7, 636	7, 367	10, 654	15, 804	19, 264
Japan	16, 972	17, 498	19, 117	22, 099	[3] 22, 000
Mexico	5, 967	6, 432	11, 220	15, 099	19, 296
Netherlands	24, 796	26, 268	26, 857	25, 712	23, 255
Northern Rhodesia	240	------------	9, 751	12, 316	18, 194
Norway	5, 359	5, 488	------------	5, 516	34, 611
Poland	123, 741	150, 299	161, 815	169, 029	174, 362
Russia [4]	1, 888	2, 266	2, 246	3, 437	4, 650
Spain	16, 065	16, 531	13, 549	11, 825	10, 697
Sweden	4, 766	4, 647	5, 106	4, 718	4, 126
United States	561, 020	537, 519	546, 649	567, 393	451, 816
Yugoslavia	2, 376	3, 185	4, 883	6, 291	5, 514
	1, 219, 000	1, 307, 000	1, 401, 000	1, 451, 000	1, 383, 000

[1] Data not available.

[2] Exclusive of secondary material (Metallgesellschaft). The figures, published by the Stat. Reichsamt, which include secondary material, are as follows: 1926, 73,716 tons; 1927, 89,837 tons; 1928, 104,707 tons; 1929, 108,429 tons. Figures for 1930 not yet available.

[3] Approximate production.

[4] Year ended Sept. 30.

The world smelter production of zinc in 1930 amounted to 1,383,000 metric tons, a decrease of 5 per cent from the record production in 1929. It was 1 per cent below the 1928 output but exceeded the production in any year prior to 1928. The American Bureau of Metal Statistics estimates the 1930 output at 1,410,915 metric tons and Metallgesellschaft at 1,404,500 metric tons.

The following table shows the rank of zinc-producing countries that contributed 1 per cent or more of the world total. Outstanding features of the table are the large decrease in importance of the United States output and the large increase in importance of the Canadian and Norwegian production.

Rank of countries producing 1 per cent or more of world's smelter output of zinc, 1929 and 1930

1929				1930			
		Production				Production	
Rank	Country	Per cent	Cumulative per cent	Rank	Country	Per cent	Cumulative per cent
1	United States	39. 1	39. 1	1	United States	32. 7	32. 7
2	Belgium	13. 6	52. 7	2	Belgium	12. 6	45. 3
3	Poland	11. 6	64. 3	3	Poland	12. 6	57. 9
4	Germany	7. 0	71. 3	4	Canada	8. 0	65. 9
5	France	6. 0	77. 3	5	Germany	7. 0	72. 9
6	Canada	5. 4	82. 7	6	France	6. 5	79. 4
7	Great Britain	4. 1	86. 8	7	Australia	4. 0	83. 4
8	Australia	3. 6	90. 4	8	Great Britain	3. 6	87. 0
9	Netherlands	1. 8	92. 2	9	Norway	2. 5	89. 5
10	Japan	1. 5	93. 7	10	Netherlands	1. 7	91. 2
11	Italy	1. 1	94. 8	11	Japan	1. 6	92. 8
12	Mexico	1. 0	95. 8	12	Mexico	1. 4	94. 2
				13	Italy	1. 4	95. 6
				14	Northern Rhodesia	1. 3	96. 9
	Other countries	4. 2	100. 0		Other countries	3. 1	100. 0
	World	100. 0	----------		World	100. 0	----------

Of the 20 countries for which zinc production was recorded in 1930, 10 showed increases, 8 decreases, and 2 virtually no change. The largest tonnage increases and their relation to 1929 output were as follows: Canada 32,158 metric tons or 41 per cent, Norway 29,095 tons or 527 per cent, Northern Rhodesia 5,878 tons or 48 per cent, Poland 5,333 tons or 3 per cent, and Mexico 4,197 tons or 28 per cent. The United States showed the largest tonnage decrease, which amounted to nearly 116,000 tons or 20 per cent of the 1929 output. Belgium's production decreased 22,900 tons or 12 per cent, while Great Britain's production declined nearly 10,000 tons or 17 per cent.

The world production of electrolytic zinc is expanding rapidly. The American Bureau of Metal Statistics reports the 1930 output at 394,090 metric tons, an increase of 20 per cent over 1929 and equivalent to 28 per cent of the total world zinc output as compared with 23 per cent in 1929. The electrolytic zinc production of the United States declined 16 per cent in 1930, whereas the foreign production increased 47 per cent. In 1930 the United States produced 30 per cent of the world's electrolytic zinc as compared with 43 per cent in 1929. Canada was the principal foreign producer in 1930, contributing 28 per cent of the total. Australia ranked second with 14 per cent and Norway third with 9 per cent. France, Northern Rhodesia, and Poland, each with about 5 per cent, and Italy with 3 per cent followed in the order named. Small quantities of electrolytic zinc were produced in Japan and Germany. Nearly all the foreign electrolytic zinc plants showed substantial increases in production in 1930. The estimated annual capacity of all plants operating during 1930 was 585,000 metric tons of cathode zinc. At the end of the year a small plant having an annual capacity of about 1,500 metric tons was under construction in France, and the Soviet Government was reported to be constructing 4 plants with a total annual capacity of approximately 100,000 metric tons.

WORLD ZINC INDUSTRY

Summaries of the zinc industry in the more important zinc-producing countries follow.

ALGERIA

Mine production of zinc in Algeria reached a peak in 1926, when ores containing 28,000 metric tons of zinc were produced; since then the yearly output has declined steadily and amounted to only 8,000 tons in 1930. This was derived from 16,940 tons of ore and concentrates averaging 47 per cent zinc. In 1929, 32,575 tons of zinc ore averaging 45 per cent zinc and 2,030 tons of mixed ore containing 14 per cent zinc and 18.5 per cent lead were produced, of which the total zinc content was nearly 15,000 tons. All the zinc ore is exported to European smelters, principally in Belgium.

AUSTRALIA

Australia ranked fifth in mine production of zinc in 1930, having produced ores and concentrates containing about 120,000 long tons of zinc—a decrease of 23 per cent from 1929. About two-thirds of the output is usually shipped to European smelters, and one-third is treated at the electrolytic zinc plant at Risdon, Tasmania. Production of metallic zinc increased from 51,872 tons in 1929 to 54,901 tons in 1930, the latter amounting to 4 per cent of the world total. Exports of metallic zinc amounted to about 32,000 tons, of which the United Kingdom took 37 per cent, Japan 32 per cent, and Belgium 17 per cent; exports to the United Kingdom increased in 1930, while those to Japan decreased. In addition, ores and concentrates containing 88,000 tons of zinc were exported. Almost all the Australian zinc production in 1930 came from the Broken Hill district. Under normal conditions Tasmania produces substantial quantities, and Queensland is expected to become a large producer within the next few years.

An event of outstanding importance to the Australian zinc industry was the termination of the contract with the British Board of Trade in June, 1930, under which Australian concentrates were purchased at a price considerably above the open market.

Anticipating the termination of this contract, British Empire zinc interests banded together to form the Imperial Smelting Corporation (Ltd.) which owns extensive smelting works in the United Kingdom. Several of the large Broken Hill producers are substantial stockholders in the corporation. During 1930 a marketing arrangement was made by which the Imperial Smelting Corporation (Ltd.) takes all zinc concentrates produced by North Broken Hill (Ltd.), Broken Hill South (Ltd.), and Zinc Corporation (Ltd.) in excess of the requirements of the Risdon plant of the Electrolytic Zinc Co. of Australasia (Ltd.). The Sulphide Corporation (Ltd.) operates its own smelter at Seaton Carew, England, and was not a party to the reorganization. The new arrangement is expected to provide a market for Broken Hill concentrates and a continuous supply of raw material to smelters in the United Kingdom.

The continued decline in the price of metals was felt acutely, particularly in the Broken Hill district. Zinc production was discontinued at some of the larger mines and some of the smaller operators closed down completely. Wage and freight-rate cuts and the decline in Australian currency averted a complete shutdown and permitted the resumption of zinc production at some mines.

New South Wales.—The Broken Hill district has supplied the larger part of the Australian zinc and lead production since about 1894. In 1930, 1,308,035 tons of ore was mined, an increase of 6 per cent over 1929, but owing to the large reduction in the quantity of dump materials treated and the curtailment of zinc production at some plants the production of lead and zinc concentrates was substantially lower. The ore mined from 1903, the earliest year for which production figures are available, to 1930, inclusive, totaled 32,520,000 tons. In 1930 the ore averaged about 15 per cent lead, 12 per cent zinc, and 7 ounces of silver.

The principal zinc-producing companies were Zinc Corporation (Ltd.), Broken Hill South (Ltd.), North Broken Hill (Ltd.), Sulphide Corporation (Ltd.), and Broken Hill Proprietary Co. (Ltd.). The Broken Hill Proprietary Block 14 Co. (Ltd.) also produced a small quantity of zinc. Details of the production of most of these companies are included in the 1930 Mineral Resources chapter on Lead. Some important developments at the principal properties follow.

The Zinc Corporation (Ltd.) was the largest zinc producer in the Broken Hill district in 1930, having made a substantial increase in output as compared with 1929. In February, 1931, the company served notice that it would suspend operations on April 25, but later it decided to shut down only one week in four as of the same date. The final dividend for 1930 was passed.

The zinc production of North Broken Hill (Ltd.) declined 54 per cent in 1930, due to a large reduction in the quantity of ore treated and the suspension of zinc concentrate production in July. The tailings from the lead flotation plant which formerly were treated for the recovery of zinc were pumped underground for use as filling, but following a reduction in freight rates the production of zinc concentrates was resumed in April, 1931. The concentrator was converted into an all-flotation plant in April, 1930; this resulted in the production of higher-grade concentrates, slightly higher recoveries, and lower costs. The British mine was closed in June, 1930, after a continuous record of production covering several years.

The quantity of ore treated by Broken Hill South (Ltd.) increased substantially in 1930, but owing to suspension of zinc production in September the zinc concentrate output for the year was 31 per cent below 1929. After decreases in wages, freight rates, and the exchange rate on Australian currency, production of zinc was resumed in April, 1931. In May, 1931, the company announced that, in accordance with the decision of the Lead Producers' Association to curtail lead production by 15 per cent, the mine would be closed one week in seven.

The Broken Hill Proprietary Co. (Ltd.) and the Broken Hill Proprietary Block 14 Co. (Ltd.) closed down in July, 1930, and the Sulphide Corporation (Ltd.) discontinued production at the end of the year.

Development and construction at the Lake George mine, Captain's Flat district, are being delayed pending decision of the New South Wales Government to finance a railway extension from Bungendore to the mine.

Queensland.—Owing to floods and an unexpected heavy flow of water underground, the Mount Isa mine did not come into production as early as expected. The first section of the 2,000-ton concentrator began working on May 11, 1931. On May 20, the sintering plant at the lead smelter started, and in the middle of June the first consignment of 200 tons of lead bullion was shipped from Townsville to the company's refinery in England. The ore reserves are reported at more than 30,000,000 tons of carbonate and sulphide ore averaging about 7 per cent lead, 6 per cent zinc, and 4 ounces of silver. Operations at present are confined largely to carbonate ore that does not contain zinc, and no announcement has been made regarding future production of zinc. In designing the mine plant at this property provision was made for an ultimate capacity of 15,000 tons per day.

Tasmania.—The Electrolytic Zinc Co. of Australasia (Ltd.) made a record production of zinc during 1930 at its electrolytic plant at Risdon. The output amounted to 54,901 tons, an increase of 6 per cent over that in 1929. Additions to the plant designed to increase its capacity to 70,000 tons per year were discontinued during the latter part of 1930, presumably as a result of a cartel agreement. The company also shut down the Rosebery mine, which was developed and equipped extensively during 1929 and 1930. A 550-ton flotation plant was completed during 1930.

BELGIUM

The production of the Belgian zinc smelters in 1930 amounted to about 175,000 metric tons, a decrease of 12 per cent from 1929. The Belgian smelters are dependent upon imported ores, domestic ores furnishing only 2 per cent of the total production. In 1930 a total of 428,000 tons of ore was imported, as compared with 610,000 tons in 1929. A large part of the decrease was due to the decline in shipments from Mexico from 19 per cent of the total imports in 1929 to only 6 per cent in 1930. Some of the principal contributors in 1930 were Italy, Sweden, India, and Australia. Belgium is one of the leading exporters of zinc. In 1930 exports of slab zinc, etc., including scrap, amounted to 60,296 tons, and exports of zinc sheets amounted to 56,068 tons. In 1929 the quantities exported were 71,549 and 62,683 tons, respectively. Europe is the principal market for these commodities. The calculated consumption of zinc in Belgium was 124,900 tons in 1930 and 133,200 tons in 1929.

The largest producer of slab zinc in Belgium and one of the largest in the world is the Société Anonyme de la Vieille Montagne. This company owns mines in many parts of the world and operates 3 zinc smelters in Belgium, 2 in France, and 1 in Germany. It also operates an electrolytic zinc plant in France. During 1930 the company produced 113,000 metric tons of zinc, or 8 per cent of the world total, compared with 112,000 tons in 1929. The 1930 output exceeded that of any other one company but did not exceed the combined output of the Anaconda Copper Mining Co. and its Polish subsidiary Giesche Spólka Akcyjna. In August, 1931, it was announced[4] that the company would curtail production at all of its plants in accordance with the cartel agreement. The company closed its Borbeck smelter in Germany in March and began shipping the roasted ore from its mines there to Belgium for smelting. During the past two years the company has been modernizing its various plants.

BOLIVIA

Bolivia increased in importance as a producer of zinc ore in 1930, having exported ore containing 6,028 metric tons of zinc as compared with 1,395 tons in 1929. This increase was due to increased production by Cia. Huanchaca de Bolivia, which operates a silver-lead-zinc-copper mine at Pulacayo, Porco Province, Department of Potosi. In January, 1930, the company began operating a flotation plant capable of treating 120,000 tons of ore per year. The company is said to have about 3,000,000 tons of proved ore, averaging 12 per cent zinc, 4 per cent lead, 0.5 per cent copper, and 16 ounces of silver per ton.[5]

CANADA

Mine production of zinc in Canada in 1930 amounted to 133,821 short tons, an increase of 36 per cent over 1929. In 1930 British Columbia contributed 94 per cent of the total, Quebec 4 per cent, and Ontario and Manitoba 1 per cent each. Production in British Columbia increased 46 per cent in 1930, while that in Quebec declined 50 per cent. Ontario's production declined substantially, and Manitoba became a zinc-producing province for the first time. A total of 121,496 tons of metallic zinc was produced in British Columbia and Manitoba in 1930, an increase of 41 per cent over 1929. British Columbia produced 98 per cent of the 1930 total.

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[4] Eng. and Min. Jour., vol. 132, No. 3, Aug. 10, 1931, p. 134.

[5] Ingalls, W. R., World Survey of the Zinc Industry: Min. and Met. Soc. of America, New York, 1931, p. 90.

Canada exports zinc on a large scale. In 1930 exports of metallic zinc amounted to 75,482 tons and exports of zinc in ore to 23,482 tons. These tonnages represent increases of 12 and 82 per cent, respectively, over 1929. Belgium took 40 per cent of the ore exported, France 37 per cent, Japan 17 per cent, and China 6 per cent; Great Britain took 63 per cent of the metallic zinc exported, Japan 18 per cent, China 2 per cent, and other countries 17 per cent. Zinc consumption in Canada in 1930 was estimated at 18,000 tons or 13 per cent of the country's total mine output.

British Columbia.—By far the largest part of the zinc output of British Columbia comes from the Fort Steele district. The following table shows the recoverable zinc produced, 1928 to 1930, by districts.

Recoverable zinc produced in British Columbia, 1928–1930, by districts, in pounds

District	1928	1929	1930
Fort Steele	167, 842, 300	162, 904, 853	218, 984, 983
Trail Creek		2, 387	19, 151, 466
Golden			11, 186, 792
Slocan	8, 735, 009	4, 510, 802	774, 818
Omineca	788, 253	482, 731	173, 388
Ainsworth	3, 662, 363	4, 050, 901	15, 859
All others	735, 222	145, 167	
	181, 763, 147	172, 096, 841	250, 287, 306

Practically all the Fort Steele district output comes from the Sullivan mine of the Consolidated Mining & Smelting Co. of Canada (Ltd.), and the 34 per cent increase in the output of the district in 1930 was due to increased production at this mine.

The increase in production from the Sullivan mine was made possible by the completion of additions to the concentrator at Kimberley, which now has a daily capacity of 6,000 tons. During the year a total of 1,910,949 tons was treated from which 217,331 tons of lead concentrates and 223,982 tons of zinc concentrates were produced. The average feed to the concentrator contained 4 pounds less lead and 18.4 pounds less zinc than in 1929; but the average tails contained 1.6 pounds less lead and 4.2 pounds less zinc, indicating the same percentage recovery of lead and a substantial improvement in zinc recovery with slight improvements in the grade of both lead and zinc concentrates.

In addition to the Sullivan mine the Consolidated Mining & Smelting Co. operates several reduction plants at Trail and Tadanac, where its own and custom ores are treated.

The total metal production of this company in 1929 and 1930 and from 1894 to 1930 is shown in the following table:

Ore treated and metals produced by the Consolidated Mining & Smelting Co., 1929 and 1930 and 1894–1930

	1929	1930	1894–1930
Ore treated......short tons..	1, 903, 637	1, 947, 004	18, 106, 677
Gold......ounces..	14, 694	25, 782	2, 228, 515
Silver......do....	7, 362, 164	6, 936, 759	83, 663, 060
Copper......pounds..	8, 346, 632	14, 127, 185	183, 015, 141
Lead......do....	300, 433, 924	302, 984, 402	2, 691, 448, 799
Zinc......do....	172, 096, 841	239, 100, 252	1, 284, 619, 970
Cadmium......do....	773, 976	456, 582	1, 722, 452

In August, 1930, the company begn operating the first unit of a new slag fuming plant designed to recover zinc and lead from lead blast-furnace slags. The first unit of the plant is capable of recovering approximately 85 tons of zinc and lead daily from products which have hitherto been considered waste. The slags which this plant treats often contain as much as 18 per cent zinc and 2 per cent lead. The zinc produced here in 1930 accounts for the large increase in production in the Trail Creek district shown on page 454. Construction of the second unit of the plant was postponed on account of unfavorable metal prices. A new unit was completed in the electrolytic zinc plant, in which the zinc oxide from the slag fuming plant is to be leached. Another new development in the treatment of zinc ores at Trail was the introduction of a new process of roasting in which the concentrates are burned in the same manner that powdered coal is fired. From 300 to 400 tons were being burned daily without the use of other fuels. The capacity of the furnaces was more than tripled; and many other advantages were claimed, including lower costs, higher recovery of zinc, and the production of a gas highly suitable for making sulphuric acid. The first 110-ton unit of a 330-ton acid plant was nearly completed at the end of 1930; the second and third units were to be completed in 1931.

The large decrease in production in the Slocan and Ainsworth districts in 1930 was due to shutdowns of many small mines. The production in the Golden district resulted from the operation of the new mill of the Base Metals Mining Corporation, which operates the Monarch mine. During the year 70,000 tons of ore containing 9.1 per cent lead, 10.4 per cent zinc, and 1.3 ounces of silver were milled, from which a total of 10,847 tons of 59.6 per cent zinc concentrates was produced in addition to lead concentrates. The zinc concentrates were shipped partly to Japan and partly to Europe. The mill was closed down on October 15.

At the Reeves-McDonald property on the Pend d'Oreille River, Nelson mining district, all activity has been curtailed pending consideration of future plans.

Manitoba.—This province became a producer of zinc for the first time as a result of the beginning of operations at the Flin Flon mine of the Hudson Bay Mining & Smelting Co. (Ltd.). The first unit of the 3,000-ton copper-zinc concentrator began operating during August. In the latter part of September the roasters were put into operation, and slab zinc was produced early in November in the new 25,000-ton-per-year electrolytic zinc plant. The copper roasters and reverberatory were started near the end of October. Shipments of metal began about the middle of November, the zinc going to Great Britain and the blister copper to the Nichols refinery on Long Island, N. Y., and to the new refinery at Montreal, Quebec. In December, 1930, the concentrator was treating 2,000 tons of ore per day, but metallurgical results had not come up to expectations. In the annual report of the company for 1930, R. E. Phelan, general manager, made the following statement as of March 20, 1931.

> The recoveries and grade of concentrates obtained in the concentrator are not yet as good as those that were obtained in the Pilot mill. This was partly due to the necessity of sending to the concentrator the ore mined in the open pit from the top of the ore body, which had been somewhat altered by surface agencies and was thus less amenable to the flotation process, and for the further reason that the ore is not ground as fine by the present operation of the grinding department in the concentrator as is necessary for the best separation and recovery of the copper and, in a greater degree, of the zinc.
>
> An investigation is now being made to see what must be done to make the grinding in the concentrator considerably finer, and laboratory tests show that when this is attained the results will be improved and will be fully equal to or better than those of the Pilot mill on which all estimates were based.

According to R. H. Channing, jr., president of the company, the Flin Flon mill treated 250,000 short tons of ore during the first quarter of 1931. Operating costs were about $3.60; indirect charges were about 90 cents; and net revenue per ton was about $4.90, indicating a profit of 40 cents a ton. The gold content of the ore handled was higher than the official estimate. Mill recoveries had improved slightly since the beginning of the year but were not yet considered satisfactory. Zinc was being sold at a premium.[6]

Development of the Sherritt-Gordon property was severely handicapped by the low metal prices. The concentrator, which was originally designed as three 500-ton units, was changed to three 600-ton units by the addition of further grinding equipment. Construction was well under way in June, 1930, but owing to the sharp break in metal prices it was decided to suspend all work on the zinc section and complete the mill for the production of copper concentrates only. In February, 1931, it was decided to bring one unit of the mill into production, and if the results of its operation and market prices were satisfactory the entire copper capacity of the mill would subsequently be operated. Meanwhile, mining operations were confined to the high-copper low-zinc sections of the ore body. The first unit of the mill came into production in March, and early in April the first shipment of copper concentrate was made to the smelter of the Hudson Bay Mining & Smelting Co. (Ltd.). The company reported satisfactory results from the start. The ore averaged 3.5 per cent copper, of which well over 90 per cent was recovered in 24 per cent concentrates. Seventy per cent of the gold and silver content of the ore was recovered. The zinc content of the ore was discarded in the mill tailings.

No developments at the Mandy mine were reported in 1930.

Northwest Territories.—Development was continued at the lead-zinc deposits at Pine Point, near Great Slave Lake. These deposits have been described by J. Mackintosh Bell.[7]

Nova Scotia.—A 250-ton flotation mill[8] was completed at the Stirling mine early in the summer. Ore sufficient to run this mill for some seven years had already been blocked out, but after being in production for a very short time the mill closed down due to falling prices. Operations at the mine during the latter part of 1930 were confined to diamond drilling. Apparently, zinc concentrates were produced during 1930, although the preliminary report of the Dominion Bureau of Statistics for 1930 does not credit any zinc production to Nova Scotia.

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[6] Eng. and Min. Jour., vol. 131, No. 9, May 11, 1931, p. 435.

[7] Bell, J. M., The Genesis of the Lead-Zinc Deposits at Pine Point, Great Slave Lake: Econ. Geol., vol. 26, No. 6, September-October, 1931, pp. 611-624.

[8] Mifflen, S. C., Mining in Nova Scotia in 1930: Canadian Min. Jour., vol. 52, No. 2, Jan. 9, 1931, p. 38.

Ontario.—Mine production of zinc in Ontario in 1930 amounted to 1,764 tons, a decrease of 36 per cent from 1929. As in 1929, virtually all the production came from the Errington mine of the Treadwell Yukon Co. (Ltd.). This company operated its experimental flotation plant up to November, 1930, during which time it treated 64,859 tons of ore containing 4.19 per cent zinc, 1.25 per cent lead, 1.13 per cent copper, 1.74 ounces of silver, and 0.037 ounce of gold. Besides copper and lead concentrates, 4,374 tons of 44.78 per cent zinc concentrate were produced. Development work was started on the 1,500-foot level in an effort to find the downward extension of the ore body developed on the 500-foot level, but up to April 8, 1931, the extension had not been found.

Quebec.—The only producer in Quebec in 1930 was the Amulet Mines (Ltd.), which operated on a complex zinc-copper sulphide ore. A new flotation plant treating 300 tons of ore a day was started in April, 1930, but was closed in October owing to poor market conditions. At the Tétreault mine, which was formerly the largest producer but which closed down in 1929, development work was continued; it is probable that production will be resumed when prices improve.

Construction of the electrolytic zinc plant near Montreal, mentioned in the report of this series for 1929, was postponed owing to the unsatisfactory condition of the zinc market.

FRANCE

France produced 90,700 metric tons of zinc in 1930, as compared with 87,330 tons in 1929; zinc consumption amounted to about 130,700 tons in 1930. The smelting industry depends largely upon foreign ore; in 1930, about 287,000 tons of ore were imported, Mexico supplying 27 per cent, Spain 18 per cent, Italy 11 per cent, and other countries 44 per cent. Imports of zinc in pigs, bars, slabs, etc., amounted to 45,340 tons in 1930 and 33,789 tons in 1929; Belgium supplied 58 per cent of the 1930 total. Exports of slab zinc declined from 11,661 tons in 1929 to 5,396 tons in 1930.

France produces only a small percentage of its zinc requirements from its own mines. In 1930, only 15,600 tons of zinc ore (concentrates) and about 5,000 tons of mixed lead-zinc ore were produced. The principal deposits are in the Departments of Gard, Hérault, and Brittany, and in the Pyrenees. One of the principal mines is the Villemagne, operated by Mining Trust (Ltd.) through a French subsidiary. In 1930 this mine produced 155,000 tons of crude ore. At the end of 1930 reserves were estimated at 389,000 tons containing 10 per cent lead and zinc combined. In August, 1931, production was reduced to 50 per cent of normal.

GERMANY

Germany produced 97,300 metric tons of metallic zinc in 1930, as compared with 102,000 tons in 1929. Mine production (zinc content of ores, etc.) increased from about 142,500 to 145,000 tons in the same years; the larger part came from Upper Silesia. As the smelting industry is located in western and central Germany, to which the large Upper Silesian ore production is not available, Germany exports large quantities of ore from Upper Silesia to the neighboring Polish smelters and imports therefrom large quantities of slab zinc. The western smelters of Germany are supplied partly by imported ore, and a substantial quantity of slab zinc is in turn exported. In 1930 Germany exported 190,595 tons of ore, of which 78 per cent went to Poland. Imports of zinc metal amounted to 109,649 tons, of which Poland supplied 60 per cent. Imports of zinc ore amounted to 134,170 tons, which came principally from Mexico, Australia, Italy, Greece, and Russia. Over 23,000 tons of crude zinc were exported, more than half of which went to Great Britain. The estimated consumption of metallic zinc decreased from 200,200 tons in 1929 to 183,500 tons in 1930.

The decline in the price of zinc during the last few years reacted unfavorably on many of the zinc-mining companies in Germany, leading to agitation by zinc producers for a protective tariff on zinc imports which was opposed by zinc consumers. Due to the political and financial crises, no action was taken by the Government. Early in 1931 a marketing agreement between Belgian and German zinc producers was completed. Continued declines in the price of zinc resulted in the closing down of many German mines and curtailment of imports; and in May, 1931, it was stated that by the end of that month only 3 out of 10 zinc smelters in Germany would be operating.

Construction of the large electrolytic zinc plant at Magdeburg apparently was postponed.

GREAT BRITAIN

Great Britain ranked third in zinc consumption and eighth in production in 1930. Consumption amounted to approximately 168,000 long tons or 13 per cent of the world total, while production amounted to only 48,598 tons or 4 per cent of the world total. Great Britain's zinc-smelting industry depends almost entirely upon foreign ores, the 1930 mine output having been reported at 647 tons.

Imports of slab zinc in 1930 amounted to nearly 136,000 tons, a decrease of 5 per cent from 1929. Canada supplied 29 per cent of the 1930 total, Germany 23 per cent, Belgium 14 per cent, the United States 12 per cent, and Australia 8 per cent. Imports of zinc concentrates, most of which came from Australia, amounted to 152,163 tons in 1930 and 132,512 tons in 1929.

The British Board of Trade contract, under which the British Government purchased Broken Hill zinc concentrates at a price considerably above the open market, expired in June, 1930. To insure a continuous and dependable supply of zinc for Great Britain and an outlet for Broken Hill concentrates an agreement was made privately by smelting interests in England and ore producers in Australia. The Imperial Smelting Corporation (Ltd.) was organized in August, 1929, to take over the control of the National Smelting

Co. (Ltd.), which owned 4,000,000 ordinary shares of Burma Corporation (Ltd.) and smelting works at Avonmouth, England, and Llansamlet, in the southern part of Wales, capable of handling 100,000 tons of concentrates annually and producing 30,000 tons of zinc and 100,000 tons of sulphuric acid. The Burma Corporation, North Broken Hill, Broken Hill South, and Zinc Corporation participated in the reorganization. The last three companies are among the largest producers in the Broken Hill district. Zinc concentrates in excess of what will be needed by the Risdon plant of the Electrolytic Zinc Co. of Australasia (Ltd.), which is controlled by the Broken Hill mining companies, will be taken by the Imperial Smelting Corporation. The Sulphide Corporation (Ltd.), one of the four largest producers at Broken Hill, operates its own smelter at Seaton Carew, England.

One of the principal uses of zinc in Great Britain is in the manufacture of zinc-coated (galvanized) products, a large part of which is exported. Exports of these products declined from 711,770 tons in 1929 to 431,654 tons in 1930. The Indian market, which is by far the largest, took only 110,112 tons in 1930 as compared with 240,117 tons in 1929.

Six units of the Coley fuming process were put into operation at Dartford, England. The fume from these plants is to be treated by continuous distillation; but as yet the details of this part of the process have not been completed, and the fume is being stored for future use.

INDIA

The Burma Corporation (Ltd.) is one of the world's important lead-zinc-silver producers and is the only producer of any consequence in India. Its mines are at Bawdwin in the Upper Shan States of Burma. During the year ended June 30, 1930, the company mined 500,585 long tons of ore, averaging 21.5 per cent lead, 11.6 per cent zinc, 1.27 per cent copper, and 18.7 ounces of silver, which brought the total ore mined from the start of operations to 3,616,103 tons. The metal output for the fiscal year was 79,267 tons of refined lead, 7,254,780 ounces of refined silver, 58,335 tons of 52.36 per cent zinc concentrates, 1,526 tons of refined antimonial lead, and 12,904 tons of copper matte. Only 64 per cent of the zinc in the ore treated was recovered in the zinc concentrates owing to the refractory nature of the ore. Ore reserves as of June 30, 1930, were estimated at 4,265,665 tons, averaging 25.5 per cent lead, 15.3 per cent zinc, 20.4 ounces of silver, and 0.88 per cent copper, a substantial increase over the preceding year, notwithstanding the large quantity of ore mined during the year. The increase was due largely to the discovery of a 1,100-foot extension of the Chinaman ore body on the No. 2 level. Subsequent development of this extension will increase the reserve considerably.

INDO-CHINA

French Indo-China produces a substantial quantity of zinc ore, but the output has declined during the last few years. In 1930 ore containing 15,900 metric tons of zinc was produced, as compared with 18,760 tons in 1929 and about 21,486 tons in 1928. The principal producer is the Société Minière et Métallurgique de l'Indochine, which produced 35,000 tons of calamine ore and smelted 3,808 tons of zinc at its smelter at Quang-Yen in 1929. About three-fourths of the ore produced is smelted abroad, principally in Belgium, France, and Japan. The zinc smelted in Indo-China goes largely to Japan.

ITALY

The mines of Italy in 1930 produced ore containing 79,528 metric tons of zinc, a decrease from 86,940 tons in 1929. Smelter production increased 22 per cent to 19,264 tons, due largely to an increase in the output of electrolytic zinc.

In terms of zinc ore the 1930 output amounted to 200,694 tons, as compared with about 224,000 tons in 1929. The Iglesias district on the island of Sardinia supplied 69 per cent of the 1929 output, and the districts of Trieste and Milano supplied 20 and 8 per cent, respectively. Italy exported nearly 145,000 tons of zinc ore in 1930, as compared with 162,000 tons in 1929. Belgium took 65 per cent of the 1930 total, France 16 per cent, and Germany 5 per cent.

Italy imports some zinc to meet its own demands. In 1930 about 6,000 tons of pig and scrap zinc and 3,600 tons of plates and sheets were imported, a total of 9,600 tons, as compared with 14,500 tons in 1929.

A decree dated October 2, 1930, increased the import duties on zinc and zinc manufactures, the increase on zinc in pig or scrap amounting to 50 per cent. Early in 1931 it was reported [9] that the Italian cabinet had approved a proposal to subsidize the Sardinian lead and zinc mining industry, to avoid shutdowns and resultant unemployment at the mines.

JAPAN

Japan consumes a large quantity of zinc, most of which is supplied from imported ores and metal. The estimated consumption in 1930 was 42,500 metric tons, a decrease of 9 per cent from 1929. The 1930 smelter output has been estimated at 22,000 tons and the mine output at 10,000 tons.

Imports of metallic zinc in 1930 amounted to 22,473 tons, a decrease of 17 per cent from 1929. Australia supplied 40 per cent of the 1930 total, Canada 39 per cent, the United States 11 per cent, and other countries 10 per cent. Imports from Canada decreased from 11,533 tons in 1929 to 8,902 tons in 1930. Imports of zinc ore amounted to 19,016 tons in 1930 and 28,492 tons in 1929.

MEXICO

The smelter production of zinc in Mexico during 1930 amounted to 19,296 metric tons, an increase of 28 per cent over 1929. Mine production amounted to 124,106 tons of zinc as compared with 174,050 tons in 1929. The decrease in mine production was due to the extremely low metal prices during 1930. Details of the mine production for 1929 and 1930 are not available. The situation in the mining industry during 1930 was summarized by Commerce Reports [10] as follows:

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[9] Min. Jour., London, vol. 173, No. 4994, May 9, 1931, p. 374.

[10] Gill, N. R., Mexican Economic Conditions Affected by Low Export Prices: Commerce Repts., Jan. 12, 1931, p. 124.

Almost without exception reports from the mining centers of Mexico indicate that conditions are becoming more serious as time passes, owing to the continued low prices of minerals, particularly that of silver. Although the output of silver, lead, copper, and zinc (the principal metals produced), together with that of other metals and minerals of lesser importance, such as gold, mercury, antimony, white arsenic, and amorphous graphite, increased in every instance during the first half of the year over the production for the same time in 1929, the increase is said to be the result of the mining companies working their richest ores and adopting all possible means to meet overhead costs. The result is that many mines are threatened with the exhaustion of their richest ores. Exploration and development work have been practically abandoned. In the emergency there has been a general effort by the companies to reduce operations and operating costs through a reduction of personnel and wages or to close down entirely. Permission from the Government to place these remedies in effect has been difficult for the larger companies to obtain, with the result that most of them have been operating at a loss for several months. Some of the smaller companies have obtained this consent.

A new mining law was placed in effect on October 1, 1930, which is said to contain several features more favorable to the mining companies than the law previously in effect.

The San Francisco Mines of Mexico (Ltd.), operating lead-zinc-silver mines in Chihuahua, increased its milling-plant capacity from 300,000 to 400,000 tons per year. The company was investigating the possibility of erecting an electrolytic zinc plant to treat its own and custom ore. A test plant was operated at Laredo, Tex., for some time, but owing to the unfavorable conditions the company did not deem this a proper time to indulge in large capital expenditures. Production of zinc concentrates was suspended for two months during 1930 and was resumed only when more favorable selling terms were obtained.

The American Smelting & Refining Co. virtually rebuilt its zinc smelter at Rosita, Coahuila. The capacity was increased from 12,600 to 47,000 metric tons of slab zinc per year. This is the only active zinc smelter in Mexico.

NETHERLANDS

The zinc-smelting industry in the Netherlands is supported entirely by foreign ore; 85,000 metric tons of ore were imported in 1930 and 78,000 tons in 1929. Most of the ore is imported through Belgium. Smelter production amounted to 23,255 tons in 1930, as compared with 25,712 tons in 1929. A large part of the zinc smelted in the Netherlands is exported, 19,257 tons having been shipped in 1930 and 22,594 tons in 1929.

NEWFOUNDLAND

At the Buchans mine a total of 188,299 long tons of ore was milled during 1930, yielding 77,960 tons of concentrates, of which about one-third was lead concentrate and two-thirds zinc concentrate. All the output in 1930 was shipped to Europe for smelting, but in 1931 lead concentrate was being shipped to the United States. Mill capacity will be increased from 500 to 1,000 tons per day, and the erection of a lead smelter is being considered.

NORWAY

Production of zinc in Norway showed a large increase in 1930, owing to the output of the new electrolytic zinc plant, at Eitrheim near Odda, which is operated by a subsidiary of Cie. Royale Asturienne des Mines. The plant is supplied largely with ores from the company's mines in northern Spain. The mine production of zinc in Norway is small.

The exports of metallic zinc were 27,097 tons in 1930 and 3,062 tons in 1929.

PERU

Owing to unfavorable market conditions and labor trouble the zinc production of Peru suffered a setback in 1930. The largest zinc producer is the Cerro de Pasco Copper Corporation, which operates the Casapalca lead-zinc mine. This company was forced to suspend operations for a time during 1930 owing to riots accompanying the revolution. In 1930 the company produced zinc concentrates containing 11,224 metric tons of zinc as compared with 13,744 tons in 1929. During the latter part of the year export of the concentrates became unprofitable, and the product was stored for future shipment.

POLAND

Poland ranked third in smelter production of zinc in 1930, having produced 174,362 metric tons, an increase of 3 per cent over 1929. In mine production in 1930 Poland ranked second to the United States. About 85 per cent of the total mine output and a large part of the smelter output are derived from ores mined in Upper Silesia. Poland also imports large quantities of zinc ore from German Upper Silesia. Of a total of 208,000 tons of zinc ore imported in 1930, Germany supplied approximately three-fourths. Most of the slab zinc produced in Poland is exported. In 1930 shipments amounted to 133,000 tons, Germany taking about half. Besides slab zinc 7,000 tons of zinc dust and 13,000 tons of zinc sheets were exported.

The largest zinc producer in Poland is Giesche Spólka Akcyjna, which produced 72,057 tons of zinc in 1930, as compared with 69,829 tons in 1929. Twenty-five per cent of the 1930 output was electrolytic zinc, as compared with 19 per cent in 1929. Slaskie Kopalnie i Cynkownie, Spólka Akcyjna ranked second in production of metallic zinc in 1930 with an output of 67,000 tons. This company began production of electrolytic zinc in 1930 at a small plant at Kamién.

RHODESIA (NORTHERN)

Zinc production in Northern Rhodesia in 1930 amounted to 17,907 long tons, an increase of 48 per cent over 1929. All the zinc was produced by the Rhodesia Broken Hill Development Co. which makes electrolytic zinc from silicate ores. Although production was maintained at a high rate throughout the year, operations resulted in a loss. Reserves at the end of the year amounted to 1,519,600 tons, a decrease of 92,470 tons from the previous year.

In January, 1931, the company began producing vanadic acid, and the production of vanadium concentrates for export was expected the latter part of the year. In March it was reported that mining operations had been suspended and that zinc production was being maintained from surface dumps. The zinc plant was finally shut down in July, 1931.

RUSSIA

The American Bureau of Metal Statistics estimates the consumption of zinc in Russia in 1930 at 46,000 metric tons, an increase of 15 per cent over 1929. As smelter production amounted to less than 5,000 tons, large imports were required. During the fiscal year ended

September 30, 1929, a total of nearly 35,000 tons was imported, of which 60 per cent came from Poland. Later data are not available.

According to V. Karmashov [11] production of zinc is expected to reach 20,000 tons in 1931 and 148,000 tons in 1933. According to official announcements production will amount to 415,000 tons in 1935 and 620,000 tons in 1937, Russia thus becoming the world's greatest zinc producer.[12]

According to Karmashov, two new zinc smelters were recently put into operation—the Konstantinovka plant in the Ukraine and the Belovsky plant in Kuzbas (Kuznetzk Basin). These plants have a combined yearly capacity of 27,000 tons of zinc. Other plants being planned or under construction and their annual capacities include Ridder electrolytic zinc plant (25,000 tons), Nerchinsk-Kemerovo (30,000 tons), Cheliabinsk electrolytic zinc plant (20,000 tons), and Vladikavkas (20,000 tons).

Owing to low metal prices the only privately operated lead-zinc property in Russia was unable to operate profitably. In August, 1931, shareholders of the Tetiuhe Mining Corporation were asked to authorize the directors of the corporation to conclude negotiations for the termination of the concession and the return of its properties to the Soviet Government. A lead smelter was built at the property recently.

SPAIN

The smelter production of zinc in Spain in 1930 amounted to 10,697 metric tons, a decrease of 10 per cent from 1929. Apparently there was little change in the mine production of zinc, although conclusive data are not available. The principal zinc mines are in the Province of Santander, which contributed 58 per cent of the 1929 output. In 1930 the production from this Province probably increased, whereas production in the southern Provinces probably decreased.

The principal zinc mine in Santander and in all Spain is the Reocin mine of the Cie. Royale Asturienne des Mines. The ore occurs in a bed of dolomitized limestone striking east and west and dipping about 22°. The ore body ranges from 1 to 15 meters in thickness, averaging 3 meters. Ore has been proved for 1,200 meters horizontally and to 500 meters in depth on the slope. The upper portions of the ore body contain oxide minerals which are now largely exhausted. The main ore body contains sphalerite and galena with virtually no silver. Reserves are estimated at 6,000,000 tons, averaging 15 per cent zinc and 2 per cent lead. Early in 1931 the company was treating about 800 tons of ore daily, and improvements to increase the capacity to 900 tons were nearly completed. Future expansion to 1,350 tons per day was being considered. Zinc concentrates containing 58 per cent zinc and 1 per cent lead and lead concentrates containing 75 per cent lead and 3 per cent zinc were being produced. The zinc concentrate was roasted locally or in France and then shipped to the company's new electrolytic zinc plant in Norway.

There are two zinc smelters in Spain, one at Arnao, Oviedo, and one at Peñarroya, Córdoba. These plants smelt only a small part of the ore produced in Spain. In 1930, 83,000 tons of blende, 34,000 tons of calamine, and 8,500 tons of calcined calamine were exported.

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[11] Karmashov, V., The Mining Industry of U. S. S. R: Eng. and Min. Jour., vol. 131, No. 3, Feb. 9, 1931, p. 132.

[12] Russian Economic Notes, U. S. Dept. of Commerce, No. 142, July 31, 1931, p. 1.

The low exchange value of the peseta during 1930 offset to some extent the low price of zinc for the zinc ore-exporting companies.

SWEDEN

The smelter output of zinc in Sweden during 1930 amounted to 4,126 metric tons, as compared with 4,718 tons in 1929. Mine production totaled about 30,000 tons of zinc. Exports of zinc ore amounted to about 73,000 tons in 1930, most of which was produced at the Ammeberg mines of Vieille Montagne and was shipped to that company's smelters in Belgium and France. About 11,000 tons of crude and sheet zinc were imported and 4,500 tons of crude and scrap zinc were exported in 1930.

The only zinc smelter in Sweden was closed down in October, 1930, on account of low metal prices.

TUNISIA

Production of zinc ores in Tunisia declined from 10,000 metric tons in 1929 to 2,000 tons in 1930. The ores are shipped to Europe for smelting; exports amounted to 6,070 tons in 1929 and 4,280 tons in 1930. Stocks amounted to 7,750 tons at the end of 1930. In May, 1931, it was reported that all zinc mines had shut down.

YUGOSLAVIA

Yugoslavia produced 5,514 metric tons of slab zinc in 1930, a decrease of 12 per cent from 1929. The zinc was derived largely from imported ores. This country now produces important quantities of zinc ore as a result of the beginning of milling operations at the Stantrg mine of Trepca Mines (Ltd.) on August 20, 1930. Up to the end of 1930 the company had treated 75,098 tons of ore containing 13.3 per cent lead and 7.6 per cent zinc, from which were produced 13,190 tons of lead concentrates, containing 72.6 per cent lead and 27 ounces of silver per ton, and 8,365 tons of 48.7 per cent zinc concentrates. At the close of the year the calculated mill recovery was 97 per cent of the lead and 83 per cent of the zinc. The mill, which was originally designed to treat 500 tons per day, was treating 700 tons at the end of the year. Other lead-zinc deposits in Yugoslavia were being investigated in 1930.

EUROPEAN ZINC CARTEL

In May, 1928, a European zinc cartel was formed to stabilize the price of zinc, which had been declining steadily throughout 1927 and the early part of 1928. Attempts were made to achieve stability by curtailing production, but they met with little success as world production decreased only slightly while stocks increased rapidly and the London price declined steadily. Finally, at a meeting in Brussels on November 19, 1929, it was decided to dissolve the cartel agreement at the close of the year. A committee was appointed to draft a new cartel agreement. During 1930 much effort was devoted toward bringing producers together in a new and more comprehensive organization. On July 19, zinc producers of Belgium, France, Germany, Silesia (Poland), Great Britain, Australia, Canada, and Mexico, representing 87 per cent of the production outside of the United States, met at Ostend and agreed to a preliminary plan, but upon submission of the plan to the various producers it failed to be ratified. According to press reports a large French-Spanish producer and Mexican and Canadian interests were dissatisfied with their production quotas and withdrew their support.

The following chronology of events from October, 1930, to October, 1931, is based largely upon reports appearing in the press; few official reports were given out by the cartel committee.

October, 1930. During the latter part of the month a meeting was held in Paris for the purpose of removing the obstacles that had resulted in the failure to ratify the Ostend agreement. Results of the meeting were negative, and it was adjourned for one month to permit further consultation.

November. The second Paris meeting did not produce an agreement, and plans to form a cartel at this time were definitely abandoned. Failure was attributed to the impossibility of securing an agreement on the quota demands of the Cie. Royale Asturienne des Mines. This company has recently developed a large mine in northern Spain and completed a large electrolytic zinc plant in Norway where the ores are reduced. As this company is undoubtedly a low cost producer, it appeared to favor an adjustment of the zinc position by curtailment brought about by natural economic laws.

December, 1930, to May, 1931. During this period apparently there was little effort to renew cartel negotiations. Natural economic laws had succeeded in reducing world production (exclusive of Belgium) from 104,000 short tons in November to 86,000 tons in May, yet in spite of this decrease world stocks had increased from 230,000 tons to 287,000 tons and the London price had fallen from about £15 per long ton to £10. Meanwhile exports from Norway increased from 2,500 to 3,500 short tons per month, indicating increased production by Royale Asturienne. About the first of May a representative of that company came to America with a plan for organization of a cartel, but it was reported that the American interests (presumably Canada and Mexico) were unwilling to accept it.

June. French, German, and Belgian producers renewed negotiations, and during the latter part of the month a plan was adopted that was approved by all European producers and by the Australian producer.

July. On July 10, a meeting of European and overseas producers was held at Ostend at which a plan was worked out that was acceptable to all present at the meeting. The essential features of the plan were as follows:

1. Signatories to the cartel included the producers of Germany, Belgium, Poland, Norway, France, Czechoslovakia, Mexico, Canada, Australia, Great Britain, Netherlands, Italy, Spain, and Rhodesia. Producers in Russia, Sweden, Yugoslavia, Asia, and the United States were not included, as the first-named four areas were large importers of zinc and the United States was not exporting any zinc produced from domestic ores.
2. The cartel is planned to be effective for 5 years beginning August 1 but may be dissolved on December 31, 1932, or at the end of any year thereafter, providing notice is given before the end of the preceding September.
3. Production capacities were prorated on the basis of the highest successive three months output between January 1, 1927, and June 30, 1930. Quotas for Canada and Norway were determined by making allowance for increased capacity of plants under construction during the period considered. This basis of proration was agreed upon at the Ostend meeting held on July 19, 1930, and the individual capacities so determined were said to aggregate 1,123,000 metric tons. Under the new agreement production by cartel members will be restricted 45 per cent or to 55 per cent of the quota basis or 618,000 tons. In 1930 these countries produced nearly 900,000 tons.
4. Individual members retain freedom in disposing of their metal up to the quota limit, and one-half of present stocks may be sold in addition to current production to meet market requirements. No limitations were placed on the grade of metal produced.

August. At a meeting held in Paris on August 18, final confirmation of individual members was obtained.

September. At the Brussels meeting on September 29, it was announced that members' stocks had been reduced by 8,000 tons during August. Satisfaction was expressed with results so far.

TARIFF

The tariff act of 1930, which became effective June 18, 1930, contains important increases in duties on zinc ores containing less than 25 per cent zinc, high-strength lithopone, and zinc sulphide. The rates under the acts of 1922 and 1930 are shown in the following statement.

Import duties on the principal zinc commodities under the tariff acts of 1922 and 1930

Par., 1930 act	Item	Import duty	
		Act of 1922	Act of 1930
393	Zinc in zinc-bearing ores:[1]		
	Containing less than 10 per cent zinc	Free	1½ cents per pound.
	Containing 10 to less than 20 per cent zinc	½ cent per pound	Do.
	Containing 20 to less than 25 per cent zinc	1 cent per pound	Do.
	Containing 25 per cent or over	1½ cents per pound	Do.
394	Zinc in blocks, pigs, or slabs and zinc dust	1¾ cents per pound	1¾ cents per pound.
	Zinc in sheets	2 cents per pound	2 cents per pound.
	Zinc in sheets coated or plated with nickel or other metal (except gold, silver, or platinum) or solutions.	2¼ cents per pound	2¼ cents per pound.
	Old and worn-out zinc, fit only to be remanufactured, zinc dross, and zinc skimmings.	1½ cents per pound	1½ cents per pound.
397	Articles or wares not specially provided for, if composed wholly or in chief value of zinc, but not plated with platinum, gold, or silver, or colored with gold lacquer, whether partly or wholly manufactured.	40 per cent ad valorem.	45 per cent ad valorem.
77	Zinc pigments:		
	Zinc oxide and leaded zinc oxide containing not more than 25 per cent of lead, in any form of dry powder.	1¾ cents per pound	1¾ cents per pound.
	Ground in or mixed with oil or water	2¼ cents per pound	2¼ cents per pound.
	Lithopone, and other combinations or mixtures of zinc sulphide and barium sulphate containing by weight less than 30 per cent of zinc sulphide.	1¾ cents per pound	1¾ cents per pound.
	Containing by weight 30 per cent or more of zinc sulphide.	do	1¾ cents per pound and 15 per cent ad valorem.
93	Zinc chemicals:		
	Zinc chloride	1 3/10 cents per pound	1 3/10 cents per pound.
	Zinc sulphate	¾ of 1 cent per pound.	¾ of 1 cent per pound.
	Zinc sulphide	1½ cents per pound	3 cents per pound.

[1] The 1930 act specifically excepts from duty: (1) The zinc content of pyrite containing less than 3 per cent zinc. (2) The zinc content of lead and copper ores not actually recovered.

IMPORTS AND EXPORTS

IMPORTS

The chief zinc import of the United States is zinc ore, most of which is imported under bond so that it can be smelted and the metallic zinc therefrom reexported without payment of import duties. In 1930, 25,839 tons of zinc in ore were imported, an increase of 79 per cent over 1929. The amount of zinc produced from foreign ore in 1930 was reported by smelters as 8,684 tons, indicating a large increase in bonded warehouse inventories.

The following tables give the Bureau of Foreign and Domestic Commerce record of zinc ore imported into the United States from 1921 to 1930 and a record of bonded warehouse inventories:

Zinc ore imported into the United States, 1921–1930, in short tons

[General imports]

Year	Canada		Mexico		Other countries		Total	
	Ore	Zinc content	Ore	Zinc content	Ore	Zinc content	Ore	Zinc content
1921	1,471	554	6,050	2,147	18	4	7,539	2,705
1922	(1)	235	(1)	1,665	(1)	29	(1)	1,929
1923	(1)	4	(1)	3,201	(1)	18	(1)	3,223
1924			(1)	4,649			(1)	4,649
1925	(1)	3,894	(1)	9,607	(1)	35	(1)	13,536
1926	(1)	2,281	(1)	12,265	(1)	21	(1)	14,567
1927	(1)	217	(1)	9,285	(1)	11	(1)	9,513
1928 [2]	(1)	18	(1)	1,646	(1)	3	(1)	1,667
1929	(1)	848	(1)	13,563			(1)	14,411
1930	(1)	13	(1)	25,644	(1)	182	(1)	25,839

[1] Gross weight not recorded.

[2] Figures probably incomplete.

Zinc remaining in warehouse in the United States, December 31, 1921–1930

Year	Ore and calamine		Blocks, pigs, and old		Zinc dust	
	Zinc content (pounds)	Value	Pounds	Value	Pounds	Value
1921	28,583,018	$647,654	262,221	$10,911		
1922			160,976	6,396		
1923	1,736,874	84,977	160,976	6,396	[1] 2,048	[1] $256
1924	12,103,110	494,605			[1] 998	[1] 38
1925	40,938,685	1,936,332				
1926	27,580,974	1,331,318				
1927	12,287,028	592,206				
1928	8,719,290	797,923				
1929	3,758,809	113,479				
1930	(2)	(2)	(2)	(2)	(2)	(2)

[1] Includes manufactures of zinc.

[2] Figures not yet available.

The United States imports very little slab zinc, rolled zinc, and manufactured zinc products. In 1930 the total value of these imports was $116,925, of which $76,062 represented the value of manufactured products. A considerable amount of old brass is imported, chiefly from Canada which supplied 88 per cent of the 1930 total. The decrease in imports in 1930 probably resulted from the low price of copper more than from the low price of zinc.

Zinc imported for consumption in the United States, 1921–1930

Year	Blocks or pigs		Sheets		Old		Zinc dust		Value of manufactures	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1921	6,598	$559,870	6,688	$496,445	6	$341	42	$1,121	$8,290	$1,066,067
1922	40	3,327	416	59,037	46	2,403	79	5,614	9,517	79,898
1923	1	375	(1)	41	20	1,624	4	891	16,331	19,262
1924	11	1,973	(1)	88	14	1,493	59	9,241	20,089	32,884
1925	(1)	303	(1)	55	24	2,495	116	20,936	18,979	42,768
1926	(1)	195	(1)	46	21	1,315	2	451	44,574	46,581
1927	39	5,089	1	271	19	1,443	(1)	114	91,519	98,436
1928	(1)	66	3	2,556	3	260	146	14,147	115,784	132,813
1929	226	21,502	(1)	52	(1)	20	159	19,543	128,395	169,512
1930	281	25,389	65	6,420	[2] 35	[2] 1,968	76	7,086	76,062	116,925

[1] Less than 1 ton.

[2] Includes 33 tons of dross and skimmings, valued at $1,829, imported June 18 to December 31; not separately recorded prior to change in tariff.

Old brass, fit only for remanufacture, imported into the United States, 1921–1930

[General imports, average composition about one-third zinc and two-thirds copper]

Year	Short tons	Value	Year	Short tons	Value
1921	20,449	$2,373,082	1926	4,311	$631,973
1922	71,967	10,985,308	1927	3,991	559,064
1923	20,395	3,992,917	1928	6,673	1,015,172
1924	4,756	698,022	1929	7,064	1,371,655
1925	5,374	772,906	1930	3,373	535,761

EXPORTS

The total value of the 1930 exports of zinc ore and domestic and foreign manufactures of zinc (not including galvanized products, alloys, and pigments) amounted to approximately $1,500,000, representing decreases of 56 per cent from 1929 and of 92 per cent from the recent high in 1925.

The following table shows the principal zinc exports of the United States during the past 10 years:

Domestic zinc ore and domestic manufactures of zinc exported from the United States, 1921–1930

Year	Zinc ore and concentrates		Pigs or slabs		Plates and sheets		Zinc dross		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921			1,753	$204,984	1,816	$125,618	510	$45,340	(1)	(1)
1922	1,695	$33,592	26,815	2,994,625	3,217	574,491	8,412	662,080	1,998	$287,890
1923	[2] 2,804	(2)	42,131	5,961,525	3,732	704,309	[3] 14,745	[3] 1,221,986	3,079	507,289
1924	[2] 368	(2)	[4] 72,583	[4] 9,538,459	3,658	784,728	[3] 10,845	[3] 974,179	2,270	353,867
1925	68,951	3,277,118	[4] 76,351	[4] 11,654,441	4,196	926,841	15,968	1,587,607	2,242	408,017
1926	95,252	4,056,067	[4] 42,920	[4] 6,360,671	4,641	1,086,967	10,461	1,100,988	1,091	224,841
1927	46,716	1,690,523	[4] 45,095	[4] 6,035,382	3,922	869,425	4,451	296,489	1,357	279,209
1928	4,518	205,978	[4] 25,289	[4] 3,013,679	4,325	901,515	3,148	240,613	1,008	199,081
1929	71	2,434	[4] 14,411	[4] 1,879,039	5,265	1,075,000	3,490	217,019	1,276	250,447
1930			[4] 4,633	[4] 450,417	3,868	761,007	1,162	57,288	1,177	194,252

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[1] Figures not available prior to 1922.

[2] Not separately enumerated by Bureau of Foreign and Domestic Commerce in 1922 and 1923 but included with zinc "dross"; Canadian smelters reported imports of 2,804 tons of zinc ore and concentrates from the United States in 1923; exporters from the Joplin district reported 368 tons of concentrates shipped to Belgian smelters in 1924.

[3] Exports of zinc ore and dross are lumped together; these figures include the quantity and value of zinc ore exported as shown in the first column.

[4] Exports of slab zinc made from foreign ore are not given separately but have been included with domestic exports after 1923.

For many years slab zinc had been the largest single item of zinc exports, but in 1930 plates and sheets accounted for 52 per cent of the total value. More than 4,600 tons of slab zinc, valued at about $450,000, were exported in 1930, a decrease of 68 per cent in quantity and 76 per cent in value from 1929. Exports of slab zinc have declined 94 per cent since 1925, due to increased production in Europe and to the inability of American producers to compete in European markets under the low price of zinc prevailing during the last few years. The drop in exports in 1930 was due largely to decreased shipments to the countries of Europe and Asia; exports to the former decreased 78 per cent and to the latter 99 per cent. France, Sweden, India, and Japan, large importers of American zinc in 1929, imported none in 1930. A very marked decrease is recorded for such important importers of American zinc as Belgium, Germany, and the United Kingdom.

The following table shows the destination of the exports of zinc ore, slab zinc, and sheet zinc in 1929 and 1930.

Domestic zinc ore and domestic and foreign manufactures of zinc exported from the United States, 1929 and 1930, by destinations

Destination	Ore and concentrates		Slabs, blocks, or pigs		Sheets, strips, etc.	
	Short tons	Value	Short tons	Value	Short tons	Value
1929						
North America:						
Canada	61	$1,950	974	$128,892	2,124	$384,602
Cuba					60	17,618
Mexico			22	3,965	149	31,919
Panama			8	1,125	25	4,929
Other			2	524	33	7,910
	61	1,950	1,006	134,506	2,391	446,978
South America:						
Argentina			3	382	193	46,740
Brazil			9	2,370	36	11,026
Chile			565	80,285	26	8,458
Colombia			44	6,033	40	9,553
Peru			4	561	17	6,048
Other	2	116	1	165	20	6,369
	2	116	626	89,796	332	88,194
Europe:						
Belgium			420	100,480		
France			2,299	289,021	13	2,338
Germany	8	368	1,961	223,138	35	4,559
Italy			56	7,397	1	228
Netherlands			554	64,491	58	8,435
Soviet Russia			8	1,254	2	490
Sweden			487	64,169	39	12,724
United Kingdom			4,717	613,235	1,592	367,664
Other			(1)	19	32	8,505
	8	368	10,502	1,363,204	1,772	404,943
Asia:						
China			(1)	57	38	12,226
India (British)			1,681	220,114	340	47,320
Japan			587	69,528	270	40,024
Philippine Islands			8	1,555	52	13,241
Other					26	7,907
			2,276	291,254	726	120,718
Africa					1	365
Oceania, including Australia			1	279	43	13,802
	71	2,434	14,411	1,879,039	5,265	1,075,000
1930						
North America:						
Canada			846	83,048	1,508	249,559
Cuba					46	13,428
Mexico			214	29,147	103	28,182
Panama					27	5,373
Other			17	1,595	92	20,483
			1,077	113,790	1,776	317,025
South America:						
Argentina			60	5,776	214	42,003
Brazil			1	119	48	14,554
Chile			1,115	116,243	7	2,194
Colombia			1	97	10	2,838
Peru			6	668	14	3,939
Other			3	349	21	6,416
			1,186	123,252	314	71,944

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[1] Less than 1 ton.

Domestic zinc ore and domestic and foreign manufactures of zinc exported from the United States, 1929 and 1930, by destinations—Continued

Destination	Ore and concentrates		Slabs, blocks, or pigs		Sheets, strips, etc.	
	Short tons	Value	Short tons	Value	Short tons	Value
1930—Continued						
Europe:						
Belgium			283	$26,705		
France					34	$6,082
Germany			564	49,647	20	2,419
Italy			224	23,557	2	386
Netherlands			588	44,621	36	7,064
Sweden					23	7,743
United Kingdom			610	62,609	1,193	245,176
Other			61	4,048	22	4,511
			2,330	211,187	1,330	273,381
Asia:						
China					31	10,096
India (British)					4	1,260
Japan					194	34,344
Philippine Islands			11	1,375	157	35,328
Other			9	813	31	8,265
			20	2,188	417	89,293
Africa					1	407
Oceania, including Australia					30	8,957
			4,633	450,417	3,868	761,007

The quantity of plates and sheets exported decreased from 5,265 tons in 1929 to 3,868 tons in 1930; the decrease in value was from $1,075,000 to $761,007. This decrease was distributed among the countries importing American plates and sheets roughly in proportion to the quantities accepted in 1929. Canada and the United Kingdom received 70 per cent of the zinc plates and sheets exported from the United States in 1930.

Exports of zinc ore and concentrates, which decreased tremendously in 1928, ceased in 1930. Exports of zinc dross decreased 67 per cent in quantity and 74 per cent in value in 1930 as compared with 1929. Exports of zinc dust amounted to 1,177 tons in 1930, as compared with 1,256 tons in 1929. Mexico took 62 per cent of the total in 1927 and in 1928, 55 per cent in 1929, and 46 per cent in 1930. The total value of brass and brass manufactures exported in 1930 decreased 26 per cent.

Domestic brass [1] and brass manufactures exported from the United States, 1921–1930

[Zinc content approximately 30 per cent by weight]

Year	Bars, plates, and sheets		Scrap and old [2]		Articles made from brass (value)	Total value
	Short tons	Value	Short tons	Value		
1921	1,437	$741,110	2,969	$405,871	$7,123,366	$8,270,347
1922	1,830	635,449	3,147	514,322	7,675,979	8,825,750
1923	1,733	703,503	6,587	1,198,560	6,917,901	8,819,964
1924	2,265	740,993	29,294	5,352,197	6,299,046	12,392,236
1925	3,988	1,359,594	48,189	9,889,153	7,315,707	18,564,454
1926	2,377	884,907	25,132	4,944,277	7,844,746	13,673,930
1927	1,756	648,853	45,997	8,824,029	8,043,131	17,516,013
1928	2,202	905,430	42,413	7,947,218	8,765,231	17,617,879
1929	2,935	1,330,119	[3] 27,746	[3] 6,167,038	10,005,920	17,503,077
1930	2,284	964,508	[3] 23,617	[3] 4,423,151	7,608,728	12,996,387

[1] Beginning 1922, classification reads "Brass and bronze."
[2] 1925–1928, inclusive, classification reads "Ingots, scrap, and old."
[3] Figures include ingots, as follows: 1929, 879 tons, valued at $267,639; 1930, 2,004 tons, $266,050.

Foreign zinc exported from the United States, 1921–1930

Year	Exported from warehouse			Exported in manufactures with benefit of drawback, slabs and sheets excluded (short tons)
	Blocks, pigs, and old		All other manufactures (value)	
	Short tons	Value		
1921	1,256	$100,677	$10,785	130
1922	3,471	429,122	30,227	1,298
1923	7,080	941,257	(1)	----------
1924–1928	(2)	(2)	(2)	----------
1929	(2)	(2)	(2)	14
1930	(2)	(2)	(2)	----------

[1] Not given separately.

[2] Exports of slab zinc made from foreign ore are not given separately but have been included with domestic exports after 1923.

CONSUMPTION

APPARENT DELIVERIES OF PRIMARY SLAB ZINC TO DOMESTIC CONSUMERS

Primary slab zinc available for consumption in the United States, 1921–1930, in short tons

	1921	1922	1923	1924	1925
Supply:					
Stock Jan. 1—					
In bonded warehouse	----------	131	80	80	(1)
At smelters	71,037	70,321	16,810	27,808	20,754
Production	200,500	354,277	510,434	517,339	572,946
Imports, foreign	6,739	52	21	25	24
Imports, domestic, returned	731	----------	----------	----------	----------
Total available	279,007	424,781	527,345	545,252	593,724
Withdrawn:					
Exports, foreign, from warehouse	1,256	3,471	7,080	(2)	(2)
Exports, foreign, under drawback	130	1,298	----------	----------	----------
Exports, domestic	3,569	30,032	45,863	[2] 76,241	[2] 80,547
Stock Dec. 31—					
In bonded warehouse	131	80	80	(1)	----------
At smelters	70,321	16,810	27,808	20,754	13,080
Total withdrawn	75,407	51,691	80,831	96,995	93,627
Available for consumption	203,600	373,090	446,514	448,257	500,097

	1926	1927	1928	1929	1930
Supply:					
Stock Jan. 1—					
At smelters	13,080	26,937	53,522	48,432	85,904
Production	618,422	592,516	602,581	625,447	498,045
Imports, foreign	22	59	3	226	346
Total available	631,524	619,512	656,106	674,105	584,295
Withdrawn:					
Exports, foreign, from warehouse	(2)	(2)	(2)	(2)	(2)
Exports, foreign, under drawback	----------	----------	----------	----------	32
Exports, domestic	[2] 47,561	[2] 49,617	[2] 29,614	[2] 19,676	[2] 8,501
Stock Dec. 31—					
At smelters	26,937	53,522	48,432	85,904	167,293
Total withdrawn	74,498	103,139	78,046	105,580	175,826
Available for consumption	557,026	516,373	578,060	568,525	408,469

[1] 998 pounds.

[2] Foreign exports included under domestic exports.

In the foregoing table an attempt has been made to include only primary slab zinc or zinc produced from ores. A substantial tonnage of redistilled secondary zinc is produced at primary smelters each year, most of which is inseparable from primary metal. For this reason smelter stocks at the end of the year and exports of domestic zinc probably contain some secondary metal. Although the amount is relatively small the slight inconsistency in the table should be noted. More precise segregation of figures for primary and secondary metal is practically impossible. As the table does not take into consideration the fluctuation in consumers' stocks the trend of consumption of primary zinc is indicated only in a general way.

The supply of new zinc available for consumption in 1930 was 28 per cent less than in 1929, 29 per cent less than in the record year of 1928, and below that in any year since 1922.

CONSUMPTION BY USES

Zinc ore may be used for the manufacture of slab zinc, zinc dust, pigments, and salts. This chapter is concerned chiefly with slab zinc, and the discussion that follows is confined to the uses of that product.

Besides the primary slab zinc a large quantity of secondary zinc was recovered in the form of slab zinc, brass and other alloys, pigments, salts, and zinc dust. These items have been discussed briefly in a previous section (p. 441) of this chapter and in more detail in the Mineral Resources chapter on Secondary Metals. The secondary zinc recovered in 1930 in the form of slab zinc, brass, and other alloys amounted to 99,300 tons. Owing to the lack of data regarding stocks it is impossible to state how much of this metal was actually consumed in 1930. It should be noted, however, that the quantity of secondary zinc recovered as slab zinc and in alloys during the past five years has averaged 26 per cent of the supply of new zinc available for consumption.

The three chief uses of slab zinc are in the manufacture of zinc-coated (galvanized) products, in brass making, and in the manufacture of sheet zinc. Other minor uses are in the manufacture of French oxide, atomized zinc dust, die castings, and slush castings and for desilverization of lead. The following table, which shows the estimated industrial use of zinc in the United States from 1922 to 1930, has been taken from the Year Book of the American Bureau of Metal Statistics, 1930.

Estimated industrial use of zinc in the United States, 1922-1930, in short tons [1]

Purpose	1922	1923	1924	1925	1926	1927	1928	1929	1930
Galvanizing:									
Sheets	110, 800	121, 300	122, 900	138, 000	142, 500	138, 500	144, 100	142, 800	103, 900
Tubes	44, 100	49, 000	50, 300	61, 100	62, 100	54, 000	54, 200	52, 200	38, 800
Wire	25, 000	32, 700	29, 000	35, 700	34, 200	38, 500	41, 300	39, 000	25, 100
Wire cloth	6, 100	6, 100	7, 100	6, 800	6, 800	6, 500	8, 400	10, 800	9, 400
Shapes [2]	19, 400	26, 100	30, 700	41, 400	44, 400	42, 500	43, 000	45, 200	39, 800
	205, 400	235, 200	240, 000	283, 000	290, 000	280, 000	291, 000	290, 000	217, 000
Brass and casting [3]	145, 000	175, 000	155, 000	165, 000	180, 000	160, 000	174, 000	180, 000	145, 000
Rolled zinc	53, 500	55, 800	61, 000	71, 100	86, 300	74, 100	73, 500	68, 300	51, 400
Die castings	(4)	(4)	(4)	(4)	13, 500	18, 000	30, 000	36, 000	21, 500
Other purposes [5]	36, 000	49, 000	56, 000	60, 000	52, 500	51, 000	58, 000	55, 000	41, 000
	439, 900	515, 000	512, 000	579, 100	622, 300	583, 100	626, 500	629, 300	475, 900

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[1] Year Book, American Bureau of Metal Statistics, 1930, p. 83.

[2] Includes pole-line hardware, hollow ware, chains, and all articles not elsewhere mentioned. The estimates for the use of slab zinc under this head, and also for wire cloth, are probably incomplete. The enumeration for 1924 includes figures from consumers not previously accounted for.

[3] Includes all casting other than die casting, slush casting, and battery zinc.

[4] Included in "Other purposes."

[5] Includes slab zinc used for manufacture of French oxide, lithopone, atomized zinc dust, die castings (through 1925), and slush castings and for the desilverization of lead.

The foregoing table is based upon reports from consumers and includes both primary and secondary slab zinc. The Bureau of Mines estimate of primary zinc available for consumption is based upon reports from producers; if the estimated production of secondary metal is added to this it will be found that the total still fails to equal the estimated industrial use of zinc, as reported by the American Bureau of Metal Statistics, by 18,000 tons or about 4 per cent of the total zinc consumed. This comparison for the past five years is shown in the following table.

Comparison of figures for consumption of zinc, 1926–1930, as computed by Bureau of Mines and by American Bureau of Metal Statistics, in short tons

	1926	1927	1928	1929	1930
Apparent consumption of primary zinc as per Bureau of Mines	557, 026	516, 373	578, 060	568, 525	408, 469
Industrial use of zinc as per American Bureau of Metal Statistics	622, 300	583, 100	626, 500	629, 300	475, 900
Excess as per American Bureau of Metal Statistics	65, 274	66, 727	48, 440	60, 775	67, 431
Recovery of unalloyed secondary zinc as per Bureau of Mines	64, 570	64, 800	70, 700	65, 400	49, 300

The estimated industrial use of zinc decreased 24 per cent and was the lowest since 1922. Consumption of iron decreased 28 per cent, copper 28 per cent, and lead 21 per cent. Some of the basic factors contributing to the decreased use of zinc were decreases of 37 per cent in the number of automobiles and trucks manufactured and 54 per cent in the industrial building contracts awarded.

The galvanizing industry is the largest user of slab zinc and has accounted for 47 per cent of the total zinc used in the United States during the past five years. In 1930 the consumption of zinc in this industry was 25 per cent less than in 1929.

Brass making provides the second largest use of slab zinc and has accounted for 29 per cent of the total consumption during the past five years. It is of interest that the use of zinc in brass has failed to keep pace with the general increase in consumption during the past few years. In 1922 about 33 per cent of the total slab zinc consumed was used in brass, whereas in 1930 the percentage was only 30 per cent. In 1930, however, the proportion of zinc entering the brass industry was 1 per cent more than in 1929. Brass exports are classified as bars, plates, and sheets, as scrap and old, and as articles made from brass; in each classification the 1930 exports were about three-fourths of those in 1929.

The use of zinc in the manufacture of rolled-zinc products again decreased in 1930, thus continuing a decline which started in 1927. The decrease in 1930 amounted to 25 per cent as compared with 1929 and 40 per cent as compared with 1926, the record year. This phase of zinc consumption has been adversely affected by the decreased use of dry cells in radio receiving sets.

Another important use of zinc, and one that presents a promising future, is as the essential constituent of die-casting alloys. From 1926 to 1929 this use of zinc increased 167 per cent; but in 1930 it fell off 40 per cent, amounting to 21,500 tons or 5 per cent of the total zinc consumption. Articles now being die cast from zinc-base alloys include loud-speaker cases, radio-instrument dials, many automobile parts (including hub caps and intricate carburetor parts), soda-water dispensers, pencil-sharpener bodies, and smoking stands. During 1929 a new die-casting alloy with high torsional and tensile strength was developed and proved to be successful for gears on the electric motor drives of gasoline pumps, shock-absorber parts, and other mechanical applications.

Other miscellaneous uses accounted for 41,000 tons of zinc or nearly 9 per cent of the total in 1930. Approximately 66 per cent of this item is chargeable to the 27,000 tons of slab zinc used in the manufacture of French-process zinc oxide, as reported by the Bureau of Mines. About 5,000 tons of zinc are used annually in the Parkes process for desilverizing lead. Some zinc was used in the manufacture of atomized zinc dust in 1930.

The question as to whether or not the American Zinc Institute should inaugurate a research program for the purpose of expanding the market for zinc was the principal subject discussed at the institute's twelfth annual meeting held in April, 1930. It was stated that the demand for galvanized products, the principal consumer of zinc, was not keeping pace with the growth of the nation, due largely to competition from products such as composition roofing. Moreover, the maintenance of this market had been left entirely in the hands of the galvanizers, whose principal interest was in selling iron and steel and who might discontinue the use of zinc should a better or cheaper coating be developed. In view of this unsatisfactory situation a research department was created in the institute to cooperate with the galvanizers in solving marketing problems. A survey of the farm market, which is one of the largest for galvanized products, indicated that the life of zinc sheets exposed to the weather ranged from a few years to 35 years. In every case superior service and long life were related to heavy zinc coatings containing 1.6 ounces or more zinc per square foot. In view of this situation, the institute adopted a "Seal of quality" trademark to be licensed to manufacturers of high-standard galvanized products. A 2-ounce coating has been specified as the standard. In October, 1931, it was reported that many manufacturers had completed license agreements with the institute. A campaign was to be conducted to educate the public as to the ultimate economy of high-grade galvanized products.

The trend in the brass industry toward the use of some alloys containing more copper and less zinc has probably been responsible for the failure of zinc to keep pace with the general expansion in the use of brass. This trend is illustrated in the consumption of brass pipe. According to W. A. Willis,[13] the quantity of brass pipe consumed between 1927 and 1929 increased 24 per cent, and the quantity of zinc used in this product decreased 7 per cent. However, the same authority believes that the general increase in the use of brass will offset the decrease in special fields, such as that mentioned above.

There were no outstanding announcements in regard to new uses of zinc in 1930. Thinly rolled zinc has been suggested as a possible dressing for wounds, as zinc is said to have the capacity to destroy pus bacteria. In Europe changing architecture is said to be decreasing the demand for zinc in roofs, and zinc furniture is now being made as a result of the modernistic trend in interior decoration.

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[13] Willis, William A., Zinc in Brass: Zn, vol. 13, 1930, p. 83.

PRICES AND VALUE

The slow upward trend in the price of zinc which persisted throughout most of 1928 continued until October, 1929, when the quotations dropped in sympathy with the collapse of the stock market. The decline in price continued without interruption until July, 1930, when the average monthly price for prime western zinc at St. Louis reached 4.33 cents per pound. Following a recovery to 4.36 cents for August the price declined to a low point of 4.06 cents for the year in October, and the year closed with an average monthly price of 4.09 cents for December. The quotation on December 31, 1930, was 4.125 cents, as compared with 5.45 cents a year before. The average for the year was 4.56 cents in 1930, as compared with 6.49 cents in 1929, a decrease of 30 per cent and the lowest since 1901. The low quotation for the year (3.95 cents) occurred on October 15, and the high (5.45 cents) occurred on January 2 and 3.

The London price followed the same general trend as the St. Louis price, declining from an average of 4.27 cents per pound in January to 2.98 cents in December. The average for the year was 3.60 cents, the lowest since 1895, and represented a decrease of 33 per cent from 1929 as compared with a decrease of 30 per cent in the St. Louis average. A differential between the London and St. Louis prices of about 1 cent per pound was maintained fairly constantly throughout the year, the average being 0.96 cent per pound in favor of the St. Louis average as compared with 1.09 cents in 1929.

The following table shows monthly fluctuations in price of prime western zinc at St. Louis during 1925 to 1930 and at London during 1930.

Average monthly quoted price of zinc at St. Louis, 1925–1930, and at London, 1930, in cents per pound [1]

Month	St. Louis (for immediate delivery)						London,[2] 1930
	1925	1926	1927	1928	1929	1930	
January	7.76	8.45	6.68	5.65	6.34	5.24	4.27
February	7.51	7.84	6.69	5.55	6.34	5.17	4.17
March	7.34	7.34	6.71	5.63	6.45	4.94	3.97
April	7.00	7.01	6.35	5.76	6.63	4.84	3.87
May	6.96	6.82	6.08	6.04	6.56	4.65	3.61
June	7.00	7.12	6.23	6.16	6.64	4.45	3.56
July	7.22	7.42	6.24	6.20	6.74	4.33	3.51
August	7.59	7.39	6.36	6.25	6.78	4.36	3.47
September	7.77	7.42	6.22	6.25	6.78	4.27	3.42
October	8.33	7.31	6.00	6.25	6.72	4.06	3.13
November	8.72	7.22	5.75	6.27	6.22	4.28	3.19
December	8.71	7.04	5.73	6.35	5.65	4.09	2.98
High monthly average	8.72	8.45	6.71	6.35	6.78	5.24	4.27
Low monthly average	6.96	6.82	5.73	5.55	5.65	4.06	2.98
Average for year	7.66	7.37	6.25	6.03	6.49	4.56	3.60

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[1] Metal Statistics, 1931, pp. 429 and 437.

[2] Conversion of English quotations into American money based on average monthly rate of exchange, as recorded by the Federal Reserve Board of the Treasury.

New York quoted prices are slightly above St. Louis prices, owing to the freight rate of 0.35 cent per pound between the two cities.

According to reports submitted to the Bureau of Mines the stocks of slab zinc at smelters increased from 85,904 tons on January 1 to 167,293 tons on December 31, 1930.

A large part (36 per cent in 1930) of the zinc ore supply of the United States is produced in the tri-State area commonly known as the Joplin region. Owing to the large quantity and the uniformity of grade and purity of the zinc concentrates produced in the district it has become the custom for the mines to sell their product to the smelters in an open market rather than under the smelter contract system usually prevailing in other mining districts. The average weekly quoted prices for 60 per cent zinc concentrates in this market during 1930 are compared with the St. Louis quotations for prime western and brass special grades of slab zinc in the following table.

Average weekly quoted prices of 60 per cent zinc concentrates at Joplin, Mo., and of zinc of "prime western" and "brass special" grades at St. Louis in 1930

Week ended—	60 per cent zinc concentrates in the Joplin region (dollars per ton) [1]	Prime western zinc in St. Louis (cents per pound) [2]	Brass special zinc in St. Louis (cents per pound) [2]	Week ended—	60 per cent zinc concentrates in the Joplin region (dollars per ton) [1]	Prime western zinc in St. Louis (cents per pound) [2]	Brass special zinc in St. Louis (cents per pound) [2]
Jan. 4	35.00	5.45	5.55	July 5	29.00	4.13¾	4.18¾
Jan. 11	35.00	5.30	5.38½	July 12	29.00	4.11¾	4.16¾
Jan. 18	35.00	5.13¾	5.25	July 19	30.00	4.20	4.25
Jan. 25	35.00	5.18	5.28	July 26	31.75	4.46½	4.51½
Feb. 1	37.00	5.25½	5.35½	Aug. 2	32.00	4.71¼	4.76¼
Feb. 8	35.00	5.23	5.33	Aug. 9	32.00	4.43	4.48
Feb. 15	37.00	5.17³⁄₁₆	5.27³⁄₁₆	Aug. 16	32.00	4.33½	4.38½
Feb. 22	37.00	5.16	5.26	Aug. 23	32.00	4.32½	4.37½
Mar. 1	37.00	5.12½	5.22½	Aug. 30	31.00	4.30	4.35
Mar. 8	37.00	5.06¼	5.16¼	Sept. 6	31.00	4.31¼	4.36¼
Mar. 15	37.00	4.95½	5.05½	Sept. 13	32.00	4.28½	4.33½
Mar. 22	37.00	4.90¼	4.99¼	Sept. 20	30.00	4.25¾	4.30¾
Mar. 29	35.00	4.85	4.95	Sept. 27	30.00	4.25	4.30
Apr. 5	35.00	4.88½	4.97½	Oct. 4	30.00	4.23	4.31
Apr. 12	35.00	4.94¼	4.99¼	Oct. 11	29.00	4.16¼	4.26¼
Apr. 19	35.00	4.85⁵⁄₁₆	4.90⁵⁄₁₆	Oct. 18	27.50	3.97½	4.07½
Apr. 26	35.00	4.76	4.81	Oct. 25	26.00	3.98	4.08
May 3	35.00	4.71½	4.77½	Nov. 1	26.00	4.01½	4.11½
May 10	33.00	4.66	4.72½	Nov. 8	26.00	4.36⅞	4.46⅞
May 17	33.00	4.63	4.69	Nov. 15	26.00	4.37	4.47
May 24	31.00	4.63½	4.68½	Nov. 22	26.00	4.27½	4.37½
May 31	31.00	4.65	4.70	Nov. 29	26.00	4.10⁷⁄₁₆	4.19¹⁵⁄₁₆
June 7	31.00	4.64	4.69	Dec. 6	26.00	4.09¼	4.19¼
June 14	31.00	4.56	4.61	Dec. 13	26.00	4.15½	4.25½
June 21	29.00	4.41¾	4.46¾	Dec. 20	26.00	4.01	4.11
June 28	29.00	4.23½	4.28½	Dec. 27	26.00	4.10⅝	4.20⅝

[1] Joplin Globe, Joplin, Mo.

[2] American Metal Market, daily.

The table shows that the price of concentrates followed the price of slab zinc very closely but did not reflect the smaller fluctuations in metal price. The average price realized on all shipments during 1930, as reported by the American Metal Market, was $31.97 per ton, which was equivalent to 2.7 cents per pound of zinc content. As the average price of slab zinc was 4.6 cents the difference of 1.9 cents per pound covers the cost of smelting and marketing, smelting profits, and metallurgical losses. In 1929 the mines realized 3.5 cents per pound of zinc contained in the concentrates, as against an average price for slab zinc of 6.5 cents per pound.

The following table shows the actual prices received by producers for various grades of zinc based upon the total value reported received.

Average price of zinc, 1921–1930, by grades, in cents per pound

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Grade A (high grade)	5.6	6.0	7.1	6.8	7.85	7.65	6.67	6.18	6.80	4.92
Grade B (intermediate)	5.5	6.0	7.1	6.8						
Grades C and D (select and brass special)	4.9	5.6	6.7	6.4	7.41	7.35	6.24	5.99	6.44	4.71
Grade E (prime western)	4.9	5.6	6.7	6.4	7.59	7.46	6.31	6.08	6.42	4.69
All grades	5.0	5.7	6.8	6.5	7.6	7.5	6.4	6.1	6.6	4.8
Prime western; average spot quotation at St. Louis	4.7	5.7	6.7	6.4	7.7	7.4	6.3	6.0	6.5	4.6

The American Metal Market reported the following average quoted prices (cents per pound) for 1929 and 1930.

	1929	1930
High-grade zinc (delivered at eastern points)	7.88	5.58
Brass special (f. o. b. East St. Louis)	6.60	4.64
Prime western (f. o. b. St. Louis)	6.49	4.56
Prime western (f. o. b. New York)	6.84	4.91

LEAD[1]

By Elmer W. Pehrson[2]

CONTENTS

	Page
General summary	479
Production	481
General	481
Primary lead	482
Refinery production	482
Geographical source of lead raw materials smelted or refined in the United States	484
Specifications for pig lead	485
Soft lead	485
Antimonial lead	486
Secondary lead	487
Pigments	488
Mine production	489
By States	489
By districts	490
Lead balance sheet of the United States	491
Lead smelters and refineries	492
Tariff	493
World aspects	493
World smelter production	493
Summary of lead industry in important lead-producing countries	495
Algeria	495
Argentina	495
Australia	496
Belgium	497
Bolivia	498
World aspects—Continued.	
Summary of lead industry in important lead-producing countries—Continued.	
Canada	498
France	500
Germany	500
Great Britain	500
India	501
Italy	501
Japan	501
Mexico	502
Newfoundland	502
Peru	503
Russia	503
South-West Africa	503
Spain	504
Tunisia	504
Yugoslavia	505
Imports	505
General imports	505
Imports for consumption	507
Exports	508
Consumption	509
Refined primary pig lead available for domestic consumption	509
Consumption by uses	510
Prices	512

GENERAL SUMMARY

Salient figures of the lead industry in the United States, 1929 and 1930

	1929	1930
Production of refined primary lead:		
From domestic ores ... short tons	672, 498	573, 740
From foreign ores and base bullion ... do	102, 135	69, 293
	774, 633	643, 033
Recovery of secondary lead:		
As pig lead ... do	138, 500	129, 000
In alloys ... do	172, 500	126, 800
	311, 000	255, 800
Total production of pig lead (primary and secondary) ... do	913, 133	772, 033
Imports (general):		
Lead in base bullion ... do	83, 071	38, 630
Lead in ore ... do	31, 331	39, 377
Exports of refined pig lead ... do	73, 251	48, 307
Refined primary lead available for consumption ... do	692, 765	582, 774
Estimated consumption of primary and secondary lead ... do	948, 500	753, 600
Prices per pound of refined lead at New York:		
Highest monthly average ... cents	7. 50	6. 25
Lowest monthly average ... do	6. 25	5. 10
Average for year ... do	6. 83	5. 52
Quotation at end of year ... do	6. 25	5. 10
Mine production of recoverable lead ... short tons	[a] 647, 995	558, 313
Southeastern Missouri district ... per cent of total	30	36
Utah ... do	23	21
Coeur d'Alene region ... do	22	23
Joplin (tri-State) region ... do	11	7
All other ... do	14	13

[a] Exclusive of the output from Virginia, figures for which the Bureau of Mines is not at liberty to publish.

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[1] Work on manuscript completed November, 1931.

[2] The statistics in this report were prepared (unless otherwise indicated) by H. M. Meyer, and the data on imports and exports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

Salient figures of the lead industry in the United States, 1929 and 1930—Continued

	1929	1930
World smelter production of lead.....short tons..	1,961,000	1,830,000
United States.....per cent of total..	36	33
Mexico.....do....	13	13
Australia.....do....	10	10
Canada.....do....	8	8
Spain.....do....	8	7
All other.....do....	25	29

Conditions in the lead industry throughout the world were far from satisfactory during 1930. The general industrial depression caused a marked decline in lead consumption with which producers failed to keep pace, so that there was a large increase in stocks and a resultant decline in prices.

In the United States the production of refined primary lead from domestic ores decreased 15 per cent in 1930 and that from foreign ores and base bullion decreased 32 per cent, making a decrease of 17 per cent in the total refined primary lead produced. Monthly production varied considerably but declined toward the end of the year, the average for the last 6 months being 11 per cent under the average for the first 6 months. The highest monthly output occurred in March and the lowest in November.

The New York quotation declined from a high of 6.25 cents per pound on January 2 to a low of 5.10 cents on December 31. The average for the year was 5.52 cents, a decrease of 19 per cent from the 1929 average of 6.83 cents and 39 per cent under the record 1925 price. The quotation was unchanged from the first of the year until the last few days in February. Thereafter a downward trend began, which continued with few interruptions until July when the price was stabilized for a time at 5.25 cents. In August and September there was a flurry upward due to some increase in demand, but early in October the price fell to 5.10 cents, where it remained for the rest of the year.

The recovery of secondary lead in pig lead and alloys declined 18 per cent in 1929 and was the lowest on record since 1925; it was equivalent to 45 per cent of the primary lead produced from domestic ores.

The consumption of lead in the United States in 1930, as estimated by the American Bureau of Metal Statistics, declined 21 per cent and was the lowest recorded since 1922. Consumption in the three major uses declined; storage batteries used 22 per cent less lead in 1930 than in 1929, cable covering 5 per cent less, and white lead 30 per cent less. As a result of the marked decline in the use of lead in storage batteries cable coverings ranked first in lead consumption in 1930. The quantity of lead used in the manufacture of white lead in 1930 was only 54 per cent of that used in the record year 1922.

Mine production of lead decreased 14 per cent in 1930. There were large decreases in the principal lead-producing States of the West and in the tri-State (Joplin) area, but the southeastern Missouri district increased its production slightly. Production in Idaho and Utah, which ranked second and third to Missouri, decreased 10 and 23 per cent, respectively. Nevada, Missouri, California, and New York showed noteworthy increases in production; New York reported lead production for the first time in more than a decade.

General imports of lead in base bullion decreased 53 per cent as a result of a 68 per cent decrease in shipments from Mexico and a 7 per cent decrease in shipments from Peru. Receipts of lead in ore and matte increased 26 per cent; Canada's shipments increased 337 per cent, whereas Mexico's decreased 30 per cent. Exports of refined pig lead declined from 73,251 tons in 1929 to 48,307 tons in 1930, due to the fact that much of the Mexican base bullion formerly refined in and exported from the United States is now being refined in Mexico and exported from there directly.

World smelter production of lead in 1930 amounted to 1,830,000 short tons, a decrease of 7 per cent from 1929. Lead smelted in the United States decreased 13 per cent, whereas foreign production decreased only 3 per cent.

The lead output of the principal foreign lead-producing countries changed as follows: Mexico declined 6 per cent, Australia declined 5 per cent, Canada increased slightly, Spain decreased 14 per cent, Germany increased 13 per cent, India declined slightly, and Belgium also declined slightly. These 7 countries and the United States produced nearly 90 per cent of the world's lead.

The London price of lead in 1930 averaged £18.075 per long ton or 3.92 cents per pound, 22 per cent below the 1929 average and the lowest yearly average in pounds sterling since 1912. The London average in 1930 was 1.60 cents per pound below the New York average, as compared with 1.79 cents in 1929.

The members of the European lead cartel, known as the Lead Producers' Reporting Association, were unable to agree in 1930 on a production-curtailment program to offset the decline in consumption and the resultant increase in stocks and decline in price. By April, 1931, however, the situation had become so acute, by reason of the pronounced decline in price during the early part of 1931, that a 15 per cent curtailment program was agreed upon to become effective on May 1. In July, it was reported that curtailment was to be increased to 20 per cent. The association maintains a statistical office in London.

Development and construction continued on a large scale at Mount Isa, Queensland, and production of lead bullion began in June, 1931. Development at the Rosebery mine, Tasmania, and at Captain's Flat, New South Wales, was stopped owing to unfavorable market conditions. In British Columbia the principal developments in 1930 were the increased production at the Sullivan mine and the starting of operations at the Monarch mine. The latter and virtually all of the small mines in the Province were closed down by the end of the year owing to low metal prices. At the Buchans mine, Newfoundland, production was maintained at the rate of about 500 tons of ore per day, and the mill capacity was being increased to 1,000 tons per day. Production at the Stantrg mine, Yugoslavia, began in August, 1930, and by the end of the year 700 tons of ore per day were being treated. No extensive discovery of lead ore was reported in the United States in 1930.

PRODUCTION

GENERAL

Pig lead produced in the United States for domestic market and export is derived from three main sources—domestic ore, foreign ore and base bullion, and secondary materials.

The following table shows the quantity of pig lead produced from each of these sources from 1921 to 1930.

Pig lead produced in the United States, 1921–1930, in short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1921	398, 222	50, 367	46, 370	494, 959
1922	468, 746	63, 916	75, 480	608, 142
1923	543, 841	74, 481	96, 430	714, 752
1924	566, 407	124, 086	90, 400	780, 893
1925	654, 921	112, 048	112, 420	879, 389
1926	680, 685	118, 256	125, 000	923, 941
1927	668, 320	128, 210	119, 000	915, 530
1928	626, 202	154, 869	138, 000	919, 071
1929	672, 498	102, 135	138, 500	913, 133
1930	573, 740	69, 293	129, 000	772, 033

The total production of pig lead in the United States in 1930 decreased 141,100 tons, or 15 per cent. Production from domestic ores and base bullion decreased 15 per cent, and that from foreign ore and base bullion decreased 32 per cent. Production of pig lead from secondary materials decreased 7 per cent.

PRIMARY LEAD

REFINERY PRODUCTION

Pig lead is classified by the Bureau of Mines as primary or secondary, according to whether it is derived directly from the smelting of ores and from base bullion or is reclaimed from junk and industrial lead scrap. Some plants that ordinarily smelt ore frequently add lead scrap to the charge, so that the resulting product is an inseparable mixture of lead from both sources and is all marketed as refined pig lead. Nevertheless, the smelter calculates the quantity of secondary lead so produced, thus enabling the Bureau of Mines to obtain a consecutive record of the amount of primary lead being supplied to the trade each year.

Primary lead may be produced from domestic ore or foreign ore and from base bullion. The smelting of lead-bearing ores from the Western States yields an impure pig lead (base bullion) that contains valuable amounts of silver and gold, in addition to objectionable impurities such as copper, arsenic, and antimony. This base bullion is given further treatment for the removal of the impurities and finally emerges for the market as refined pig lead. The smelting of lead-bearing ores from the Mississippi Valley and Southern States yields soft lead pure enough for marketing, but some of it is desilverized and is designated in this report as desilverized soft lead. Foreign ore is first smelted into base bullion and then refined for market. Foreign base bullion imported into the United States is also refined before marketing. All these products for market are referred to as refined lead.

The following table gives a summary of the refined primary lead produced in the United States from 1720 to 1930.

Refined primary lead produced in the United States, 1720–1930

Year	Short tons							Value	
	Desilverized lead [1] [2]	Desilverized soft lead	Soft lead[2]	Total production [1]	From domestic ores and base bullion	From foreign ores	From foreign base bullion	Average per pound	Total
1720–1912	7, 176, 497	326, 991	2, 929, 180	10, 432, 668	8, 545, 383	1, 887, 285		--------	[3] $925, 600, 000
1913	301, 160	29, 433	131, 867	462, 460	411, 878	13, 223	37, 359	$0. 044	40, 696, 000
1914	340, 397	43, 506	158, 219	542, 122	512, 794	7, 639	21, 689	. 039	42, 286, 000
1915	344, 593	44, 001	161, 461	550, 055	507, 026	9, 581	33, 448	. 047	51, 705, 000
1916	335, 375	68, 244	167, 515	571, 134	552, 228	6, 085	12, 821	. 069	78, 817, 000
1917	365, 998	56, 268	188, 503	610, 769	548, 450	15, 872	46, 447	. 086	105, 052, 000
1918	382, 314	47, 418	210, 463	640, 195	539, 905	15, 334	84, 956	. 071	90, 908, 000
1919	266, 538	67, 938	147, 744	482, 220	424, 433	7, 656	50, 131	. 053	51, 115, 000
1920	273, 135	66, 668	189, 854	529, 657	476, 849	8, 414	44, 394	. 080	84, 745, 000
1921	238, 329	52, 747	157, 513	448, 589	398, 222	7, 120	43, 247	. 045	40, 373, 000
1922	249, 107	74, 305	209, 250	532, 662	468, 746	13, 898	50, 018	. 055	58, 593, 000
1923	366, 241	61, 332	190, 749	618, 322	543, 841	24, 288	50, 193	. 070	86, 565, 000
1924	423, 429	63, 449	203, 615	690, 493	566, 407	46, 385	77, 701	. 080	110, 479, 000
1925	457, 477	48, 932	260, 560	766, 969	654, 921	47, 024	65, 024	. 087	133, 453, 000
1926	484, 669	55, 707	258, 565	798, 941	680, 685	48, 210	70, 046	. 080	127, 831, 000
1927	507, 099	55, 487	233, 944	796, 530	668, 320	32, 369	95, 841	. 063	100, 363, 000
1928	506, 603	49, 465	225, 003	781, 071	626, 202	26, 632	128, 237	. 058	90, 604, 000
1929	483, 622	55, 666	235, 345	774, 633	672, 498	29, 675	72, 460	. 063	97, 604, 000
1930	396, 094	45, 578	201, 361	643, 033	573, 740	34, 348	34, 945	. 050	64, 303, 000
	13, 898, 677	1, 313, 135	6, 460, 711	21, 672, 523	18, 372, 528	3, 299, 995		--------	2, 381, 092, 000

[1] The lead content of antimonial lead is excluded (see p. 487).

[2] Desilverized soft lead is excluded.

[3] Corrected figures.

The total production of refined primary lead in the United States in 1930 was 17 per cent less than that in 1929 and less than that in any year since 1923. The total value of the output in 1930 was 34 per cent less than that in 1929 because of decreases in both quantity and average price. The value of the output in 1930 was less than one-half that in the record year 1925.

Outstanding features in the production of primary lead in the United States in 1930 were the increased output from foreign ores, the sharp decrease in production from foreign base bullion, and the decrease in production from domestic ores. Lead smelted from foreign ores increased 16 per cent in 1930 and was equivalent to over 5 per cent of the total primary output; that produced from foreign base bullion decreased 52 per cent and amounted to only a little more than 5 per cent of the total as compared with 9 per cent of the total in 1929. The total lead derived from foreign primary raw materials was 11 per cent of the total in 1930, as compared with 13 per cent in 1929 and 20 per cent in 1928. The production of refined lead from domestic ores decreased 15 per cent in 1930 and was less than that recorded for any year since 1924.

The following table shows the quantity and value of refined lead produced in the United States from domestic ores from 1921 to 1930.

Refined lead produced in the United States from domestic ores, 1921–1930

Year	Short tons	Value	Year	Short tons	Value
1921	398, 222	$35, 840, 000	1926	680, 685	$108, 910, 000
1922	468, 746	51, 562, 000	1927	668, 320	84, 208, 000
1923	543, 841	76, 138, 000	1928	626, 202	72, 639, 000
1924	566, 407	90, 625, 000	1929	672, 498	84, 735, 000
1925	654, 921	113, 956, 000	1930	573, 740	57, 374, 000

GEOGRAPHICAL SOURCE OF LEAD RAW MATERIALS SMELTED OR REFINED IN THE UNITED STATES

The following table shows the source of the ore and foreign base bullion from which refined lead was produced in the United States from 1921 to 1930. A large part of the base bullion produced in the Western States is shipped to the Mississippi Valley and Eastern States for refining. In reporting the production of lead by sources most of the refiners make the distribution on the basis of base bullion, so that the total lead given in this table as from domestic ore includes both base bullion and refined lead and thus contains a large part of the antimonial lead produced from domestic ores. The domestic total given here for 1930 exceeds the total production of refined lead from domestic ores, as shown in the preceding table, by 6,273 tons. The production of antimonial lead from domestic ores in 1930 amounted to 8,918 tons.

Primary lead smelted or refined in the United States, 1921–1930, by sources, in short tons

Source of ore	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Domestic ore:										
Alaska	773	324	400	582	699	1,018	1,010	962	1,266	1,320
Arizona	3,313	7,218	8,828	9,372	10,281	10,646	7,918	8,144	8,153	4,223
Arkansas [1]	--------	--------	--------	--------	--------	--------	--------	--------	--------	41
California	614	3,018	5,168	2,305	4,148	4,044	1,232	637	1,459	1,848
Colorado	12,104	11,108	23,885	25,491	31,855	37,553	37,040	28,683	23,675	25,091
Idaho	99,707	91,487	127,797	123,709	123,363	132,564	150,618	141,748	147,595	135,411
Illinois [1]	271	750	1,286	1,089	474	357	222	398	777	268
Kansas [1]	10,939	10,900	20,207	12,895	15,001	20,884	[2] 25,463	[2] 27,014	[2] 26,104	[2] 13,105
Kentucky [1]	41	73	66	201	96	27	139	268	303	87
Missouri [1]	151,028	202,245	169,323	191,501	208,547	218,083	210,366	192,789	211,345	201,056
Montana	11,565	14,551	18,345	21,226	22,008	26,370	23,041	20,470	26,795	15,412
Nevada	3,553	4,264	8,044	8,070	10,978	11,379	8,680	6,823	13,256	14,091
New Mexico	384	1,230	1,638	2,263	3,782	4,383	8,377	8,469	12,249	11,250
New York [1]	--------	--------	--------	--------	--------	--------	--------	--------	--------	(3)
Oklahoma [1]	46,902	67,436	59,602	56,017	78,487	70,004	[2] 47,857	[2] 46,692	[2] 45,653	[2] 23,598
Oregon	--------	37	47	--------	6	5	2	7	15	7
South Dakota	2	2	--------	2	2	1	79	37	--------	--------
Tennessee [1]	--------	751	1,020	985	436	770	19	--------	--------	--------
Texas	1	5	40	27	31	102	275	437	559	240
Utah	51,872	63,130	104,678	119,318	166,844	151,127	155,199	151,724	157,085	122,311
Virginia [1]	--------	--------	--------	1,582	2,179	1,714	2,214	4,944	(3)	(3)
Washington	325	478	2,008	2,057	2,802	2,262	442	537	447	577
Wisconsin [1]	1,079	1,323	601	1,973	2,889	2,032	2,067	1,812	1,729	1,832
Undistributed	101	75	691	15	2	--------	--------	--------	5,624	7,452
Zinc residues	713	1,284	362	1,320	1,541	505	1,905	102	1,903	995
	395,287	481,689	554,036	582,000	686,451	695,830	684,165	642,697	685,992	580,013
Foreign ore:										
Africa	--------	--------	99	6	--------	6	12	--------	--------	--------
Australia	--------	--------	--------	--------	--------	--------	2	2	5	3
Canada	2,877	3,604	3,632	4,633	10,676	5,385	4,138	10,123	9,499	14,369
Central America	6	14	18	30	6	--------	18	3	--------	--------
Europe	17	519	139	328	470	233	19	67	28	41
Mexico	1,912	7,260	18,867	33,328	31,107	32,693	22,844	14,836	16,807	14,949
South America	2,235	2,458	1,461	7,663	4,496	9,893	5,306	1,568	3,285	3,476
Other foreign	73	43	72	397	269	--------	--------	30	51	1,510
Foreign base bullion:										
Canada	1,599	2,900	--------	--------	--------	--------	--------	--------	--------	--------
Mexico	41,648	47,118	50,193	77,701	65,024	70,046	95,841	117,196	51,295	18,392
South America	--------	--------	--------	--------	--------	--------	--------	11,044	21,165	16,553
	50,367	63,916	74,481	124,086	112,048	118,256	128,380	154,869	102,135	69,293
Grand total	445,654	545,605	628,517	706,086	798,499	814,086	812,545	797,566	788,127	649,306

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[1] The lead produced by these States is nonargentiferous or soft lead. A small quantity of the lead produced from Colorado and New Mexico ores is also nonargentiferous.

[2] The smelter output of lead in Kansas and Oklahoma is separated on the basis of mine output as the Bureau of Mines has been unable to obtain an accurate separation of smelter output.

[3] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

The table shows substantial decreases in lead production in 1930 in most of the important lead-producing States. Increased production was recorded for Alaska, California, Colorado, Nevada, Washington, and Wisconsin. Production was reported for Arkansas and New York in 1930 for the first time since 1918. Foreign ore smelted in the United States in 1930 came largely from Mexico, Canada, and South America (chiefly Bolivia). Shipments of ore from Japan (probably originating in Siberia) accounted for the increase shown for "other foreign" countries. Production of refined lead in the United States from Mexican base bullion was 64 per cent less in 1930 than in 1929 and 84 per cent less than in 1928; this decline was due to the completion of new refining capacity in Mexico in 1929. Production of refined lead from South American (Peruvian) base bullion decreased 23 per cent.

SPECIFICATIONS FOR PIG LEAD

The American Society for Testing Materials classifies pig lead in three grades—corroding, chemical, and common. The requirements as to chemical composition are shown in the following table.

Allowable chemical composition of the various grades of pig lead, as specified by the American Society for Testing Materials

	Corroding lead,[1] not over—	Chemical lead [2]	Common lead	
			Desilverized lead, not over—	Soft Missouri lead, not over—
	Per cent	*Per cent*	*Per cent*	*Per cent*
Silver	0.0015	0.005–0.015	0.002	0.002
Copper	.0015	.04 – .08	.0025	.040
Copper and silver together	.0025	(3)	(3)	(3)
Arsenic	.0015	(3)	.015	.015
Antimony and tin together	.0095	(3)		
Zinc	.0015	(3)	.002	.002
Iron	.002	(3)	.002	.005
Bismuth	.05	(4)	.25	.005
Lead, by difference	99.9300	(5)	99.7265	99.931

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[1] The maximum limits for bismuth, copper, and silver have been given, but it is not expected that any delivery will contain the maximum of all three.

[2] Chemical lead is a designation that has been used for many years in the trade to describe the undesilverized lead produced from southeastern Missouri ores.

[3] Not given.

[4] Less than 0.005 per cent.

[5] Not specified.

SOFT LEAD

Soft pig lead is smelted from nonargentiferous lead ores of high purity, most of which are produced in the Mississippi River Basin. The recoverable lead content of all ores mined in the United States in 1930 was about 559,000 tons, of which 246,000 tons or 44 per cent was contained in nonargentiferous or soft lead ores. The southeastern Missouri district contributed 81 per cent of the total soft lead mined; the tri-State district (Joplin) contributed 15 per cent; and Virginia, New York, and Wisconsin contributed most of the remaining 4 per cent.

The production of soft pig lead in 1930 amounted to 246,939 tons, a decrease of 15 per cent from that in 1929 and equivalent to 43 per cent of the total production of domestic refined primary lead. Eighty-two per cent of the soft pig lead produced in 1930 was marketed without desilverizing, and 18 per cent was desilverized. The former, which is known in the trade as chemical lead, contains 1 to 4 ounces of silver to the ton and 0.01 to 0.08 per cent copper; it is used chiefly in the manufacture of cable, pipe, and sheets. Desilverized soft lead is used largely in the manufacture of white lead, where a very pure product is required.

A substantial quantity of high-grade lead concentrates from the Mississippi Valley is used each year in the manufacture of lead pigments, principally basic lead sulphate (white sublimed lead) and leaded zinc oxide. In 1930 over 6,600 tons of soft lead were recovered in this manner.

Soft lead recovered in soft pig lead and lead pigments amounted to 43 per cent of the total domestic primary lead recovered in pig lead, pigments, and antimonial lead in 1930.

The following table summarizes the production of soft lead from 1922 to 1930.

Soft lead produced in the United States from domestic ores, 1922–1930, in short tons

Year	Soft pig lead			Soft lead recovered in pigments	Total soft lead	Total domestic lead [1]	Soft lead percentage of domestic lead
	Undesilverized	Desilverized	Total				
1922	209, 250	74, 305	283, 555	13, 892	297, 447	488, 448	61
1923	190, 749	61, 332	252, 081	13, 612	265, 693	567, 247	47
1924	203, 615	63, 449	267, 064	15, 338	282, 402	593, 486	48
1925	260, 560	48, 932	309, 492	17, 547	327, 039	684, 968	48
1926	258, 565	55, 707	314, 272	13, 685	327, 957	710, 990	46
1927	233, 944	55, 487	289, 431	13, 136	302, 567	695, 500	44
1928	225, 003	49, 465	274, 468	10, 465	284, 933	652, 492	44
1929	235, 345	55, 666	291, 011	9, 429	300, 440	696, 678	43
1930	201, 361	45, 578	246, 939	6, 686	253, 625	588, 042	43

[1] Includes domestic refined lead, domestic lead in antimonial lead, and domestic lead in pigments.

ANTIMONIAL LEAD

Antimonial lead is an important by-product of the refining of base bullion. In 1930, 13,711 tons of primary antimonial lead were produced, a decrease of 47 per cent from the 1929 output and equivalent to 3.5 per cent of the total refined lead produced from base bullion.

The decreased importation of base bullion from Mexico had a marked effect upon the production of primary antimonial lead. In 1929, 8,600 tons were produced from the smelting and refining of foreign ores and base bullion, whereas in 1930 only 4,800 tons were derived from the same source. Foreign ores also yield a higher percentage of antimonial lead. The production of antimonial lead from foreign ores was equivalent to 8.4 per cent of the refined lead produced from those ores in 1929 and to 6.9 per cent in 1930, while the yield from domestic ores was 4.5 and 2.7 per cent, respectively.

The principal uses of antimonial lead are in the manufacture of storage batteries, bearing metal, and type metal. The consumption of antimonial lead in storage batteries decreased about 14 per cent in 1930.

The following table shows the production of primary antimonial lead from 1921 to 1930.

By-product primary antimonial lead produced in the United States, 1921–1930

Year	Total lead refined from base bullion (short tons)	By-product antimonial lead (percentage of total)	Antimonial lead						
			From domestic ore (short tons)	From foreign ore (short tons)	Total				
					Short tons	Value	Antimony content		Lead content by difference (short tons)
							Short tons	Percentage	
1921	238, 329	4. 2	7, 881	2, 183	10, 064	$870, 059	1, 589	15. 8	8, 475
1922	249, 107	3. 2	7, 068	1, 007	8, 075	844, 993	1, 441	17. 8	6, 634
1923	366, 241	3. 9	11, 635	2, 555	14, 190	1, 950, 370	2, 170	15. 3	12, 020
1924	423, 429	4. 9	13, 593	7, 194	20, 787	3, 376, 713	2, 763	13. 3	18, 024
1925	457, 477	4. 3	14, 472	5, 195	19, 667	3, 785, 547	2, 624	13. 3	17, 043
1926	484, 669	4. 6	18, 909	3, 615	22, 524	3, 916, 714	2, 693	12. 0	19, 831
1927	507, 099	4. 8	16, 040	8, 307	24, 347	3, 277, 043	2, 736	11. 2	21, 611
1928	506, 603	6. 5	17, 930	15, 128	33, 058	3, 978, 318	3, 432	10. 4	29, 626
1929	483, 622	5. 3	17, 062	8, 607	25, 669	3, 267, 095	3, 052	11. 9	22, 617
1930	396, 094	3. 5	8, 918	4, 793	13, 711	1, 392, 524	1, 685	12. 3	12, 026
Average		4. 7						12. 6	

SECONDARY LEAD

Much of the lead consumed in the United States is used in the manufacture of articles from which there is a large return of secondary metal. This is particularly true of the storage-battery industry, which is a leading consumer of lead and in which there is a large and rapid return of secondary metal. This industry is responsible for much of the increase in the ratio of secondary lead production to domestic primary lead production. In 1914 the secondary output was equivalent to only 12 per cent of the primary output from domestic ores; in 1930 the ratio was 45 per cent, a decrease from 46 per cent in 1929. Other important lead-consuming industries in which there is a large return of secondary metal include cable manufacture, building, bearing-metal manufacture, and type-metal manufacture.

The quantity of secondary lead recovered in 1930 was almost equally divided between that recovered as pig lead and that recovered in the form of alloys.

The following tables show the recovery of secondary lead and its ratio to the refined primary lead produced in the United States from domestic ores. Further details of the secondary lead industry may be found in the Mineral Resources chapter on Secondary Metals.

Secondary lead recovered in the United States, 1922–1930 [1]

Year	Pig lead (short tons)	Lead in alloys (short tons)	Total recovered lead	
			Short tons	Value
1922	75, 480	84, 080	159, 560	$17, 552, 000
1923	96, 430	98, 060	194, 490	27, 229, 000
1924	90, 400	114, 100	204, 500	32, 720, 000
1925	112, 420	114, 460	226, 880	39, 477, 000
1926	125, 000	152, 300	277, 300	44, 368, 000
1927	119, 000	157, 000	276, 000	34, 776, 000
1928	138, 000	170, 600	308, 600	35, 798, 000
1929	138, 500	172, 500	311, 000	39, 186, 000
1930	129, 000	126, 800	255, 800	25, 580, 000

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[1] Compiled by J. P. Dunlop, of the Bureau of Mines.

Ratio of secondary lead recovered to refined primary lead produced in the United States from domestic ores, 1913–1930

Year	Refined primary lead		Secondary lead	
	Short tons	Average price per pound (cents)	Short tons	Ratio to refined primary lead (per cent)
1913	411, 878	4. 4	72, 834	18
1914	512, 794	3. 9	61, 962	12
1915	507, 026	4. 7	78, 900	16
1916	552, 228	6. 9	96, 300	17
1917	548, 450	8. 6	93, 500	17
1918	539, 905	7. 1	97, 100	18
1919	424, 433	5. 3	122, 100	29
1920	476, 849	8. 0	124, 650	26
1921	398, 222	4. 5	103, 780	26
1922	468, 746	5. 5	159, 560	34
1923	543, 841	7. 0	194, 490	36
1924	566, 407	8. 0	204, 500	36
1925	654, 921	8. 7	226, 880	35
1926	680, 685	8. 0	277, 300	41
1927	668, 320	6. 3	276, 000	41
1928	626, 202	5. 8	308, 000	49
1929	672, 498	6. 3	311, 000	46
1930	573, 740	5. 0	255, 800	45

PIGMENTS

Lead pigments manufactured in 1930 contained 197,557 tons of lead derived from the sources shown in the following table. Refined pig lead is used in the manufacture of white lead, litharge, red lead, sublimed lead, and orange mineral. In 1930 about 190,000 tons of the lead contained in lead pigments were derived from refined pig lead; white lead accounted for 45.9 per cent; litharge, 35.5 per cent; red lead, 16 per cent; and sublimed lead and orange mineral, 2.6 per cent. Sublimed lead and leaded zinc oxide are the principal pigments in which the lead content is derived from ores.

Further details of the production and value of lead pigments in the United States are given in the Mineral Resources chapter on Lead and Zinc Pigments and Salts.

Lead in pigments,[1] 1922–1930, by sources, in short tons

Year	Lead in pigments from—				
	Domestic ore	Foreign ore	Metal	Scrap	Total
1922	13, 892		241, 096	111	255, 099
1923	13, 612		236, 541		250, 153
1924	15, 338	545	250, 930		266, 813
1925	17, 547		256, 064		273, 611
1926	13, 685		240, 902	1, 029	255, 616
1927	13, 136		242, 713	1, 246	257, 095
1928	10, 465		242, 914	654	254, 033
1929	9, 429		248, 657	2, 427	260, 513
1930	6, 686		190, 182	689	197, 557

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[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.

MINE PRODUCTION

BY STATES

The following table shows the mine production of recoverable lead by States from 1921 to 1930.

Mine production of recoverable lead, 1921–1930, by States, in short tons

State	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Alaska	759	377	410	631	789	778	1,008	1,019	1,315	1,365
Arizona	3,271	7,535	8,146	9,321	11,938	11,629	9,933	7,190	8,027	4,246
Arkansas	21	42	25	20	58	18	23	38	51	53
California	562	3,156	4,775	2,382	3,283	4,047	1,359	946	715	1,780
Colorado	9,830	11,739	22,849	23,779	31,483	34,494	33,386	26,751	24,445	22,130
Georgia	--------	4	--------	--------	--------	--------	--------	--------	--------	--------
Idaho	99,235	97,917	121,178	124,475	126,521	136,490	151,019	145,323	148,695	134,058
Illinois	672	1,325	1,381	1,464	1,001	655	277	385	443	248
Kansas	18,679	23,271	17,598	18,560	22,775	28,463	27,497	25,276	26,596	12,910
Kentucky	69	92	53	175	152	58	139	39	287	101
Massachusetts	--------	--------	--------	(1)	--------	--------	--------	--------	--------	--------
Missouri	180,085	178,412	169,743	189,929	211,566	207,012	198,760	195,393	198,469	199,632
Montana	10,183	14,884	17,973	19,738	18,765	21,153	17,949	16,880	19,607	10,653
Nevada	3,594	4,695	9,078	10,030	12,238	11,184	7,892	7,874	9,846	11,529
New Mexico	339	1,506	1,916	1,817	3,210	3,480	8,026	7,805	11,130	10,378
New York	--------	--------	--------	--------	--------	--------	--------	--------	--------	(2)
Oklahoma	41,552	62,856	66,904	71,358	79,946	69,704	51,680	43,687	46,513	23,052
Oregon	--------	38	14	(3)	3	6	3	7	10	5
South Dakota	2	--------	--------	--------	--------	--------	69	37	--------	--------
Tennessee	--------	732	1,250	937	448	800	--------	--------	--------	(2)
Texas	--------	4	13	--------	8	42	244	348	425	198
Utah	44,594	67,666	101,724	116,955	153,335	147,635	151,285	145,915	149,377	115,495
Virginia	--------	--------	--------	1,275	2,229	2,450	2,393	(4)	(4)	(2)
Washington	72	691	1,453	1,968	2,814	2,273	478	542	508	576
Wisconsin	972	691	734	1,254	1,877	1,546	2,069	1,698	1,536	1,537
Undistributed	--------	--------	--------	--------	--------	--------	--------	--------	--------	8,367
	414,491	477,633	547,217	596,068	684,439	683,917	665,489	[5] 627,153	[5] 647,995	558,313

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[1] It is said that a few tons of lead ore were mined at the old Chipman mine in Massachusetts and treated at a small smelter owned by the mine operators.

[2] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

[3] 513 pounds.

[4] Bureau of Mines not at liberty to publish figures.

[5] Exclusive of the output from Virginia, figures for which the Bureau of Mines is not at liberty to publish.

Mine production decreased 14 per cent in 1930. There were large decreases in the principal lead-producing States of the West and in the tri-State (Joplin) area. Missouri again ranked first in production, having contributed 36 per cent of the total; its output was slightly higher in 1930 than in 1929, due to increased production in the southeastern Missouri district. Idaho and Utah ranked second and third in production in 1930 and showed decreases of 10 and 23 per cent, respectively. Percentage decreases in other important lead-producing States were: Oklahoma, 50 per cent; Colorado, 9 per cent; Kansas, 51 per cent; Montana, 46 per cent; New Mexico, 7 per cent; and Arizona, 47 per cent. Noteworthy increases were recorded in Nevada, Missouri, California, and New York; New York reported lead production for the first time in more than a decade.

Detailed information concerning the mining activities in the various districts of the United States can be found in the chapters of this series dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

BY DISTRICTS

The following table gives the lead production in the principal lead-producing districts.

Mine production of recoverable lead in the principal lead-producing districts of the United States, 1922–1930, in short tons

District	State	1922	1923	1924	1925	1926	1927	1928	1929	1930
Southeastern Missouri region.	Missouri	176, 768	167, 458	187, 737	208, 915	203, 062	196, 251	194, 270	197, 435	198, 622
Coeur d'Alene region.	Idaho	91, 216	114, 426	118, 327	120, 856	128, 834	141, 948	139, 276	141, 558	129, 311
Bingham	Utah	19, 348	25, 353	34, 786	54, 982	54, 997	55, 508	52, 375	49, 447	42, 586
Joplin region	Kansas, Missouri, Oklahoma.	87, 771	86, 787	92, 110	105, 372	102, 117	81, 686	70, 086	74, 143	36, 972
Park City region	Utah	16, 129	26, 220	33, 346	40, 656	35, 910	41, 403	41, 427	42, 570	30, 875
Tintic	do	23, 646	38, 906	40, 674	45, 889	47, 108	45, 045	44, 096	44, 113	29, 474
San Juan Mountains.	Colorado	5, 332	13, 157	13, 148	17, 092	19, 237	21, 739	18, 555	17, 386	11, 722
Rush Valley	Utah	586	1, 284	926	2, 465	5, 022	7, 346	7, 222	11, 751	10, 157
Leadville	Colorado	2, 742	2, 804	4, 795	6, 931	9, 266	6, 781	5, 168	5, 172	6, 808
Willow Creek	New Mexico	-------	-------	-------	-------	-------	4, 353	5, 193	5, 720	5, 431
Pioche	Nevada	932	2, 697	2, 152	2, 806	2, 420	639	1, 167	2, 986	4, 868
Barker	Montana	971	846	1, 272	1, 420	1, 387	412	264	6, 137	4, 578
Central	New Mexico	176	656	592	1, 182	1, 306	954	1, 180	3, 766	3, 936
Tybo	Nevada	-------	-------	1	3	1	-------	-------	1, 991	3, 622
Eagle County	Colorado	161	230	1, 145	2, 041	1, 305	2, 059	750	198	2, 821
Butte	Montana	10, 070	12, 745	13, 648	12, 091	13, 678	12, 769	12, 330	8, 239	2, 540
San Francisco	Utah	1, 118	1, 489	1, 069	1, 999	1, 325	420	199	691	1, 883
Warm Springs	Idaho	1, 758	925	357	355	149	478	1, 307	1, 507	1, 793
Inyo County	California	3, 135	4, 744	2, 306	3, 098	3, 278	1, 081	872	670	1, 711
Upper Mississippi Valley.	Iowa, Northern Illinois, Wisconsin.	1, 259	948	1, 639	2, 355	1, 819	2, 141	1, 706	1, 536	1, 537
Jack Rabbit	Nevada	791	536	120	224	578	1, 266	2, 561	2, 430	1, 464
Eagle	Montana	-------	-------	-------	-------	-------	-------	-------	-------	1, 287
Pend d'Oreille	Idaho	238	304	67	113	481	1, 048	694	863	956
Banner	Arizona	2, 140	1, 731	160	49	7	13	490	2, 938	929
Dome	Idaho	-------	-------	276	602	246	1, 182	1, 074	1, 870	829
Yellow Pine	Nevada	158	736	3, 855	2, 644	952	826	1, 105	535	483
Magdalena	New Mexico	462	753	818	1, 217	700	819	496	481	479
Aspen	Colorado	1, 778	1, 486	455	1, 820	1, 632	1, 203	806	710	396
Kentucky-Southern Illinois.	Kentucky-Illinois.	849	1, 220	1, 254	675	440	344	416	730	349
Northport	Washington	534	1, 062	1, 232	2, 218	1, 984	325	503	76	254
Spruce Mountain	Nevada	237	261	508	647	1, 099	636	529	388	202
Eureka	do	251	673	888	2, 163	2, 784	1, 132	466	378	183
Boulder	Idaho	-------	-------	(1)	(1)	(1)	(1)	(1)	(1)	168
Bisbee (Warren)	Arizona	4, 187	4, 221	5, 719	6, 657	5, 729	5, 256	2, 917	1, 020	151
Big and Little Cottonwood.	Utah	2, 754	3, 831	3, 128	2, 374	1, 597	1, 009	146	173	125
Cedar Plains	Montana	23	274	230	175	346	373	657	1, 177	120
Vulture	Arizona	3	-------	4	26	133	133	1, 291	777	86
Texas	Idaho	2, 168	2, 417	2, 197	1, 714	2, 882	3, 895	1, 195	182	76
Montana	Montana	775	912	1, 241	1, 427	2, 069	1, 866	1, 432	493	74
Summit County	Colorado	280	1, 946	1, 105	1, 707	1, 481	614	786	369	29
Bryant	Montana	158	968	1, 743	1, 150	730	398	195	344	25
Ophir	Utah	2, 921	3, 443	1, 414	2, 945	217	157	101	25	18
Troy	Montana	1, 528	1, 059	530	259	231	181	33	49	-------
Port Hill	Idaho	1, 440	2, 116	2, 317	1, 506	1, 597	468	414	-------	-------
New Placers	New Mexico	-------	-------	3	125	527	1, 100	48	-------	-------
Mammoth	Nevada	5	2	21	331	365	1, 195	21	-------	-------
Bell	do	612	1, 160	-------	128	455	143	-------	-------	-------
Austinville [2]	Virginia	-------	-------	1, 275	782	1, 582	2, 393	(1)	(1)	(1)
Embree [2]	Tennessee	732	1, 250	937	448	800	-------	-------	-------	(1)
Oro Blanco [2]	Arizona	-------	-------	1	4	-------	7	707	(1)	(1)
St. Lawrence County.[2]	New York	-------	-------	-------	-------	-------	-------	-------	-------	(1)

[1] Bureau of Mines not at liberty to publish figures.

[2] Not listed according to rank.

LEAD BALANCE SHEET OF THE UNITED STATES

Most of the lead ore mined in the United States is smelted, and its lead content emerges in marketable form as primary refined pig lead and antimonial lead. Some of the ore is used in the manufacture of pigments and some may be exported, but for several years the amount exported has been negligible. The total primary domestic lead in the various products in which it is produced for market is compared in the following table with the estimates of recoverable lead in the ore mined. The table begins with 1907, the first year for which the mine production of the entire country was determined. As the quantities compared were determined by independent canvasses of the producers and consumers of lead-bearing ore, the table gives a check on the accuracy of the figures.

Comparison of mine production of lead and primary domestic lead accounted for in lead products manufactured in the United States, 1907–1930, in short tons

Year	Mine production	Primary lead accounted for in—				Primary excess (+) or mine excess (−)
		Refined lead	Antimonial lead	Pigments made from ore	Total	
1907–1918	5,653,706	5,249,081	124,168	121,756	[1] 5,503,330	−150,376
1919	429,589	424,433	8,339	11,179	[2] 443,954	+14,365
1920	496,814	476,849	8,032	15,212	500,093	+3,279
1921	414,491	398,222	6,675	9,989	414,886	+395
1922	477,633	468,746	5,810	13,892	488,448	+10,815
1923	547,217	543,841	9,794	13,612	567,247	+20,030
1924	596,068	566,407	11,741	15,338	593,486	−2,582
1925	684,439	654,921	12,500	17,547	684,968	+529
1926	683,917	680,685	16,620	13,685	710,990	+27,073
1927	665,489	668,320	14,044	13,136	695,500	+30,011
1928	[3] 627,153	626,202	15,825	10,465	652,492	+25,339
1929	[3] 647,995	672,498	14,751	9,429	696,678	+48,683
1930	558,313	573,740	7,616	6,686	588,042	+29,729
1919–1930	6,829,118	6,754,864	131,747	150,170	7,036,784	+207,666
1907–1930	12,482,824	12,003,945	255,915	271,926	12,540,114	+57,290

[1] Includes 8,325 tons of lead produced from domestic ores smelted outside the country.
[2] Includes 3 tons of lead produced from domestic ores smelted outside the country.
[3] Exclusive of the output from Virginia, figures for which the Bureau of Mines is not at liberty to publish.

The table shows substantial discrepancies for individual years, probably due largely to variations in mine and smelter stocks of ore, but in none of the last 12 years has the discrepancy exceeded 7 per cent of the total lead produced. From 1907 to 1918, inclusive, mine production exceeded the primary lead accounted for in lead products by 150,000 tons, or less than 3 per cent. From 1919 to 1930 there was an excess of 208,000 tons, or about 3 per cent, in favor of the lead contained in the lead products. For the total period of 24 years, 1907 to 1930, the primary lead content of lead products exceeded mine production by only 57,290 tons, or less than one-half of 1 per cent.

LEAD SMELTERS AND REFINERIES

A list of lead smelters and refineries in the United States, Canada, and Mexico follows.

UNITED STATES

Arizona: Douglas—Phelps Dodge Corporation. (Smelter.)
California: Selby—Selby plant, American Smelting & Refining Co. (Smelter and refinery.)
Colorado:
  Durango—Durango plant, American Smelting & Refining Co. (Smelter.)
  Leadville—Arkansas Valley plant, American Smelting & Refining Co. (Smelter.)
Idaho: Bradley—Bunker Hill & Sullivan Smelter. (Smelter and refinery.)
Illinois:
  Collinsville—St. Louis Smelting & Refining Works of National Lead Co. (Smelter and refinery.)
  Federal—Federal plant, American Smelting & Refining Co. (Smelter.)
Indiana:
  East Chicago—International Lead Refining Co.[3] (Refinery only.)
  East Chicago—U. S. S. Lead Refinery (Inc.)[4] (Refinery only. Betts electrolytic process.)
Kansas: Galena—Galena plant, Eagle-Picher Mining & Smelting Co. (Smelter.)
Missouri:
  Granby—American Zinc, Lead & Smelting Co.[5] (Smelter.)
  Herculaneum—St. Joseph Lead Co. (Smelter and refinery.)
  Joplin—Eagle-Picher Lead Co. (Smelter.)
Montana: East Helena—East Helena plant, American Smelting & Refining Co. (Smelter.)
Nebraska: Omaha—Omaha plant, American Smelting & Refining Co. (Smelter and refinery.)
New Jersey:
  Newark—Balbach plant, U. S. Metals Refining Co. (Smelter and refinery.)
  Perth Amboy—Perth Amboy plant, American Smelting & Refining Co. (Smelter and refinery.)
Oklahoma: St. Louis—Ontario smelter, Eagle-Picher Lead Co. (Smelter.)
Pennsylvania: Carnegie—Pennsylvania Smelting Co.[5] (Smelter and refinery.)
Texas: El Paso—El Paso plant, American Smelting & Refining Co. (Smelter.)
Utah:
  International—International Smelting Co.[3] (Smelter.)
  Midvale—United States Smelting, Refining & Mining Co. (Smelter.)
  Murray—Murray plant, American Smelting & Refining Co. (Smelter.)

CANADA

British Columbia: Trail—Consolidated Mining & Smelting Co. of Canada (Ltd.). (Smelter and refinery. Betts electrolytic process.)
Ontario: Galetta—Kingdon Mining, Smelting & Manufacturing Co. (Ltd.). (Smelter.)

MEXICO

Chihuahua: Chihuahua—American Smelting & Refining Co. (Smelter.)
Coahuila: Torreon—American Metal Co. (Ltd.). (Cia. Metalúrgica de Torreon.) (Smelter.)
Hidalgo: Zimapan—Cïa. Min. y Fundidora de Zimapan. (Smelter.)
Nuevo Leon:
  Monterrey—American Metal Co. (Ltd.). (Cia. Minera de Peñoles—S. A.) (Smelter and refinery.)
  Monterrey—American Smelting & Refining Co. (Smelter and refinery.)
San Luis Potosi: San Luis Potosi—American Smelting & Refining Co. (Cia. Minera Asarco.) (Smelter.)
Sinaloa: Mazatlan—Cia. Mexicana de Minerales.[5] (Smelter.)
Zacatecas: La Fé—American Metal Co. (Ltd.). (Cia. Minera de Peñoles—S. A.) (Smelter.)

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[3] Subsidiary of Anaconda Copper Mining Co.
[4] Subsidiary of the United States Smelting, Refining & Mining Co.
[5] Plant idle in 1930.

TARIFF

The tariff act of 1930 became effective June 18, 1930. The only change in the lead schedules from the 1922 act was in the item "Articles or wares not specially provided for, if composed wholly or in chief value of lead, but not plated with platinum, gold, or silver, or colored with gold lacquer, whether partly or wholly manufactured." The import duty on articles coming under this classification was increased from 40 per cent to 45 per cent ad valorem. The following table gives the duties on the principal lead items under the new act.

Import duties on lead commodities under the tariff act of 1930

Paragraph	Item	Import duty
391	Lead-bearing ores, flue dust, and matte of all kinds. (Duty shall not apply to lead content of copper, gold, or silver ores, or copper mattes unless actually recovered.)	1½ cents per pound on lead content.
392	Lead bullion or base bullion, lead in pigs and bars, lead dross, reclaimed lead, scrap lead, antimonial lead, antimonial scrap lead, type metal, Babbitt metal, solder, all alloys or combinations of lead not specially provided for.	2⅛ cents per pound on lead content.
	Lead sheets, pipe, glazier's lead, and lead wire	2⅜ cents per pound on lead content.
397	Articles or wares n. s. p. f., if composed wholly or in chief value of lead, but not plated with platinum, gold, or silver, or colored with gold lacquer, whether partly or wholly manufactured.	45 per cent ad valorem.
72	Lead pigments:	
	Litharge	2½ cents per pound.
	Orange mineral	3 cents per pound.
	Red lead	2¾ cents per pound.
	White lead	2½ cents per pound.
	All pigments containing lead, dry or in pulp, or ground in or mixed with oil or water, n. s. p. f.	30 per cent ad valorem.
46	Lead chemicals:	
	Acetate, white	2½ cents per pound.
	Acetate, brown, gray, or yellow	2 cents per pound.
	Nitrate, arsenate and resinate	3 cents per pound.
	All other lead compounds, n. s. p. f.	30 per cent ad valorem.

WORLD ASPECTS

WORLD SMELTER PRODUCTION

The following table shows the world smelter production of lead from 1926 to 1930, so far as statistics are available. Official figures are used wherever possible. For countries for which official data are not yet available the figures are taken from the yearbook of the American Bureau of Metal Statistics and other reliable sources, but in later reports the official statistics will be substituted as received.

There is always a possibility of duplication in figures showing world production, for some countries send "work lead" or base bullion to other countries for refining. Furthermore, secondary lead and antimonial lead are often included in the figures showing the foreign production, whereas the figures for the United States represent only refined primary lead that was smelted in this country, whatever the source of the ore; refined lead produced from foreign base bullion is excluded.

World production of lead, 1926–1930, in metric tons [1]

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [2]	1926	1927	1928	1929	1930
Argentina	8, 200	7, 800	8, 291	9, 020	8, 882
Australia	155, 398	167, 616	157, 565	180, 358	171, 248
Austria	6, 478	8, 086	8, 135	6, 569	6, 935
Belgium	87, 876	91, 710	86, 260	82, 850	[3] 80, 000
Canada	123, 644	134, 157	136, 561	138, 095	138, 105
Chosen	1, 958	824	719	333	130
Czechoslovakia	2, 316	2, 502	3, 065	4, 609	4, 225
France	19, 495	32, 076	22, 656	20, 358	19, 400
Germany [4]	76, 600	84, 000	87, 000	97, 900	110, 800
Great Britain	4, 334	6, 132	8, 638	10, 839	10, 383
Greece	5, 059	5, 325	7, 306	5, 361	7, 329
India (Burma)	55, 202	67, 026	79, 642	81, 521	80, 829
Indo-China	1	4	10	17	11
Italy	23, 590	23, 774	21, 220	22, 650	24, 340
Japan	3, 610	3, 394	3, 653	3, 374	[3] 3, 000
Mexico	182, 886	230, 782	227, 860	233, 154	219, 370
Northern Rhodesia	3, 897	5, 951	4, 751	1, 661	----------
Norway	385	[3] 300	[3] 300	[3] 300	[3] 300
Peru	122	171	14, 466	19, 448	14, 979
Poland	27, 924	29, 574	37, 078	35, 789	40, 900
Portugal	140	60	84	94	[3] 90
Rumania	655	828	537	565	984
Russia [5]	1, 342	1, 217	2, 592	6, 200	4, 500
South-West Africa [6]	1, 682	3, 535	5, 004	2, 802	2, 856
Spain	149, 514	144, 023	130, 950	142, 753	123, 263
Sweden	522	330	----------	----------	----------
Tunisia	18, 106	18, 662	17, 606	18, 850	19, 500
Turkey	5, 509	6, 531	8, 062	7, 324	5, 766
United States (refined) [7]	661, 239	635, 651	592, 238	636, 997	551, 645
Yugoslavia	9, 809	10, 672	13, 875	9, 471	10, 049
	1, 637, 000	1, 723, 000	1, 686, 000	1, 779, 000	1, 660, 000

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[1] By countries where smelted but not necessarily refined.

[2] In addition to the countries listed China smelts lead, but no reliable data of ouput are available. Official estimates of production in 1925 range from 1,500 to 3,500 tons.

[3] Approximate production.

[4] Exclusive of secondary material. (Metallgesellschaft, Frankfort.)

[5] Year ended Sept. 30.

[6] Year ended Mar. 31 of year following that stated.

[7] Figures cover domestic refined and lead refined from foreign ore; refined lead produced from foreign base bullion not included.

The world smelter production of lead in 1930, as compiled by the Bureau of Mines, amounted to 1,660,000 metric tons, a decrease of 7 per cent from 1929. The American Bureau of Metal Statistics estimates the 1930 output at 1,664,465 metric tons, 5 per cent less than its estimate of the 1929 output. The Metallgesellschaft, of Frankfort on the Main, reports the 1930 world output at 1,629,200 metric tons, or 7 per cent below the 1929 output.

The following table shows the rank in lead production of the various countries that produced 1 per cent or more of the world total in 1929 and 1930.

Rank of the countries producing 1 per cent or more of the world's lead, 1929 and 1930

1929				1930			
Rank	Country	Production		Rank	Country	Production	
		Per cent	Cumulative per cent			Per cent	Cumulative per cent
1	United States	35.8	35.8	1	United States	33.2	33.2
2	Mexico	13.1	48.9	2	Mexico	13.2	46.4
3	Australia	10.1	59.0	3	Australia	10.3	56.7
4	Spain	8.0	67.0	4	Canada	8.3	65.0
5	Canada	7.8	74.8	5	Spain	7.4	72.4
6	Germany	5.5	80.3	6	Germany	6.7	79.1
7	Belgium	4.7	85.0	7	India	4.9	84.0
8	India	4.6	89.6	8	Belgium	4.8	88.8
9	Poland	2.0	91.6	9	Poland	2.5	91.3
10	Italy	1.3	92.9	10	Italy	1.5	92.8
11	France	1.1	94.0	11	Tunisia	1.2	94.0
12	Peru	1.1	95.1	12	France	1.2	95.2
13	Tunisia	1.1	96.2				
	Other countries	3.8	100.0		Other countries	4.8	100.0
	World	100.0			World	100.0	

Of the 13 countries listed in the foregoing table for 1929, 8 showed decreases in 1930 production, 4 increases, and 1 virtually no change.

The largest tonnage decreases and their relation to 1929 outputs were as follows: United States 85,352 tons or 13 per cent, Spain 19,490 tons or 14 per cent, Mexico 13,784 tons or 6 per cent, Australia 9,110 tons or 5 per cent, and Peru 4,469 tons or 23 per cent. Germany showed the largest tonnage increase—12,900 tons or 13 per cent. Poland's lead production increased 5,111 tons or 14 per cent in 1930, while Greece and Italy increased their outputs 37 and 7 per cent, respectively.

SUMMARY OF LEAD INDUSTRY IN IMPORTANT LEAD-PRODUCING COUNTRIES

ALGERIA

Lead ore produced in Algeria is smelted chiefly in Europe. In 1930, 12,790 metric tons of lead and lead-silver ore averaging 55 per cent lead were produced, as compared with 14,227 tons averaging 56 per cent in 1929. Exports of lead ores amounted to 22,279 tons in 1930, as compared with 20,156 tons in 1929. These figures include some shipments from other countries, probably Tunisia and Morocco.

ARGENTINA

Argentina ranked second in South American lead production in 1930, with an output of 8,882 metric tons, a decrease of 2 per cent from 1929. Production of concentrates amounted to 5,835 tons averaging 77.41 per cent lead, all of which came from the Province of Jujuy. Some Bolivian lead ores are smelted in Argentina. About 1,200 tons of secondary lead was produced from battery plates and other scrap materials.

The Cia. Minera y Metalurgica Sud Americana, controlled by the National Lead Co., is the principal lead producer. It operates a group of mines near Pumahuasi, Province of Jujuy, and a lead smelter and refinery at Buenos Aires. The Compañia Minera Aguilar, S. A., a subsidiary of the St. Joseph Lead Co., is developing a lead property in the Aguilar district, Province of Jujuy. Production is expected in 1932.

Argentina consumes more lead than it produces, imports of lead bars and plates amounting to about 5,700 tons a year.

AUSTRALIA

Australia ranked third in smelter production of lead in 1930, with an output of 168,543 long tons, a decrease of 5 per cent from 1929 and 10 per cent of the world total. All but a small part of the lead ore mined in Australia, most of which was derived from the Broken Hill district, New South Wales, was smelted at Port Pirie, South Australia. A small quantity of lead bullion was produced at the State smelter at Chillagoe, Queensland. Mine production of lead in 1930 amounted to 197,595 tons, of which 93 per cent was contained in Broken Hill lead concentrates, 3 per cent in Broken Hill zinc concentrates, and 4 per cent in ores from other districts. Exports of pig lead and lead bullion in 1930 amounted to 152,216 tons, and exports of lead in lead ore and concentrates amounted to 17,666 tons. Europe took 96 per cent and Japan 2 per cent of the pig lead and lead bullion, and Belgium took 56 per cent of the lead ore and concentrates.

The production and ore reserves of the five principal producers in the Broken Hill district in 1930 are shown in the following table.

Production and ore reserves of the five principal producers in the Broken Hill district in 1930

	Zinc Corporation	Broken Hill South	North Broken Hill	Sulphide Corporation	Broken Hill Proprietary	
	Ore	Ore	Ore	Ore	Ore	Dump material
Material treated ....long tons..	337,041	358,830	378,233	140,510	68,555	47,929
Lead content ....per cent..	15.3	15.2	14.6	14.6	(1)	(1)
Zinc content ....do....	10.0	12.1	11.3	14.6	(1)	(1)
Silver content ....ounces..	3.2	5.9	8.9	11.5	(1)	(1)
Lead concentrates produced...long tons..	67,950	73,631	76,510	25,883	19,925	
Lead content ....per cent..	71.6	70.4	68.1	68.0	(1)	
Zinc content ....do....	5.2	5.7	6.6	7.5	(1)	
Silver content ....ounces..	14.2	26.3	38.4	51.0	(1)	
Lead recovered ....per cent..	94.5	94.8	94.4	85.8	(1)	
Silver recovered ....do....	90.6	91.1	87.1	81.7	(1)	
Zinc concentrates produced...long tons..	53,105	40,789	39,980	33,970	13,753	
Zinc content ....per cent..	51.0	49.9	49.6	51.5	(1)	
Lead content ....do....	2.6	2.0	2.2	2.7	(1)	
Silver content ....ounces..	1.0	1.5	3.1	5.1	(1)	
Zinc recovered ....per cent..	80.3	84.3	79.6	85.3	(1)	
Ore reserves ....long tons..	[2] 3,129,000	[3] 4,250,000	[3] 4,200,000	[2] 779,184	(1)	

[1] Data not available.
[2] As of Dec. 31, 1930.
[3] As of June 30, 1930.

Notwithstanding the unfavorable market conditions and the expiration of the contract with the British Board of Trade, under which zinc concentrates were sold at a price considerably above the world price, the mines of the Broken Hill district produced more lead in

1930 than in 1929. As the contract did not expire until June, 1930, producers probably maintained peak production up to that time. During the latter half of the year several mines shut down completely and others continued producing only lead, the zinciferous tailings from the lead flotation plants being pumped underground for filling. A feature of the year's operations was the increase in the grade of lead concentrates. The average lead content of the concentrates produced from ore by four of the principal producers was 69.8 per cent in 1930 and 64.5 per cent in 1929. This increase in grade, together with increased recovery, was accomplished by improvement in flotation practice. Some of the plants are now operating on an all-flotation basis.

At the beginning of 1931 only three companies were operating, and by the middle of the year two of these were working on a part-time basis in accordance with cartel agreements. The third company was operating on a reduced tonnage, having closed down one of its mines in 1930. Meanwhile wages had been reduced, freight rates had been lowered, and the exchange rate on Australian currency had declined. These factors mitigated, somewhat, the extremely low metal prices and no doubt were largely responsible for continued operation of the three properties working at the middle of 1931.

Development and construction work at the Lake George mine, Captain's Flat, New South Wales, was postponed pending decision of the provincial government to finance the branch railway from Bungendore.

In Queensland development and construction at Mount Isa continued on a large scale throughout 1930. Production was expected early in 1931, but owing to floods and an unexpected heavy flow of water in the mine there was some delay. The first section of the 2,000-ton concentrator began working on May 11, 1931. On May 20, the sintering plant at the lead smelter started, and in the middle of June the first consignment of 200 tons of bullion was shipped from Townsville to the company's new lead refinery at Northfleet on the Thames, England. The refinery was completed in July, 1931, and has a capacity of 6,000 tons per month.

The Rosebery mine in Tasmania, which was developed and equipped extensively during 1929 and 1930, was shut down in January, 1931, owing to low metal prices.

BELGIUM

Belgium ranked third in European lead production and eighth in world production in 1930. Its output in 1930 has been estimated at 80,000 metric tons, slightly less than in 1929. The mines of Belgium produce little lead ore, so that the smelting industry depends upon imports for its raw materials. In 1930 Belgium imported 40,160 tons of lead ore, as compared with 42,424 tons in 1929, and 34,320 tons of lead in pigs (most of which was probably base bullion) and scrap, as compared with 31,338 tons in 1929. Another important source of lead is the residue from the smelting of imported zinc ores, although this source is less important now than formerly owing to the relatively low lead content of zinc concentrates under present metallurgical practice. Belgium exported about 21,000 tons of pig lead and 19,000 tons of lead sheets and pipe in 1930.

BOLIVIA

Bolivia produces considerable lead ore, all of which is exported. In 1930, 16,091 metric tons of ore containing 71.70 per cent lead was exported, a decrease of 18 per cent in quantity as compared with 1929. A small amount of old slag containing about 50 per cent lead was also exported in 1930. Belgium and Argentina are the principal importers of Bolivian lead.

CANADA

The smelter production of lead in Canada in 1930 amounted to 152,235 short tons, a few tons more than the 1929 production. Canada ranked fourth in world production, having contributed over 8 per cent of the total. Mine production amounted to 166,447 tons in 1930 as compared with 163,261 tons in 1929. British Columbia supplied over 96 per cent of the 1930 mine output, Yukon less than 3 per cent, and Ontario less than 1 per cent; there was no production in Quebec in 1930. Exports of pig lead amounted to 102,716 tons in 1930 and 114,187 tons in 1929; Great Britain took 47 per cent of the total in 1930, Japan 34 per cent, China 3 per cent, and other countries 16 per cent. Exports of lead in ore increased from 7,988 tons in 1929 to 13,162 tons in 1930, virtually all of which was shipped to the United States.

British Columbia.—By far the largest part of the Canadian production is derived from the Sullivan mine of the Consolidated Mining & Smelting Co. in British Columbia. In 1930, 1,924,017 tons of ore were produced from this mine, as compared with 1,778,000 tons in 1929. Total shipments of ore from 1894 to the end of 1930 amounted to 12,004,559 tons. The company also owns large reduction works at Tadanac and Trail, British Columbia, where the ore from its own and independent mines is treated. The company's production of principal metals in 1929 and 1930 and from 1894 to 1930 has been reported as follows:

Ore treated and metals produced by the Consolidated Mining & Smelting Co., 1929 and 1930 and 1894–1930

	1929	1930	1894–1930
Ore treated...short tons..	1,903,637	1,947,004	18,106,677
Gold...ounces..	14,694	25,782	2,228,515
Silver...do....	7,362,164	6,936,759	83,603,000
Copper...pounds..	8,346,632	14,127,185	183,015,141
Lead...do....	300,433,924	302,984,402	2,691,448,799
Zinc...do....	172,096,841	239,100,252	1,284,619,970
Cadmium...do....	773,976	456,582	1,722,452

Notwithstanding the depressed condition of the metal markets the company increased its output of all principal metals except silver and enlarged its capacity in 1930. The new units put into operation included an addition to the concentrating plant at Kimberley, which now has a daily capacity of 6,000 tons. The first unit of a new slag fuming plant designed to recover zinc and lead from lead blast-furnace slags began operating in August, 1930. The plant is capable of recovering approximately 85 tons of zinc and lead daily from products that have hitherto been considered waste. The slags which this plant treats often contain as much as 18 per cent zinc and 2 per cent lead.

Construction of the second unit has been postponed on account of unfavorable metal prices. A new lead blast furnace with 50 per cent more capacity than the former standard furnace was put into operation during 1930. Several improvements were also made in the zinc plant. Substantial reductions in the costs of mining, milling, and smelting were reported in 1930.

The total mine production of lead in British Columbia in 1930 amounted to 160,902 tons, of which the Fort Steele district produced 95 per cent, chiefly from the Sullivan mine. The remaining 5 per cent came largely from the Golden, Portland Canal, and Slocan districts. There was a large increase in the production in the Golden district due to operations at the Monarch mine of the Base Metals Mining Corporation. During the year 70,000 tons of ore containing 9.1 per cent lead, 10.4 per cent zinc, and 1.3 ounces of silver, were milled from which a total of 7,751 tons of 76.8 per cent lead concentrates was produced. This was shipped to the smelter at Selby, Calif. The mill was shut down on October 15 on account of low metal prices, but development work in the mine was continued to the end of the year.

Northwest Territories.—Development was continued at the lead-zinc deposits at Pine Point, near Great Slave Lake. These deposits have been described by J. Mackintosh Bell.[6]

Nova Scotia.—A 250-ton flotation[7] mill was completed at the Stirling mine early in the summer. Ore sufficient to run this mill for some seven years had already been blocked out, but after being in production for a very short time the mill was closed due to falling prices. Operations at the mine during the latter part of 1930 were confined to diamond drilling. Apparently, some lead concentrates were produced during 1930, although the preliminary report of the Dominion Bureau of Statistics for 1930 does not credit any lead production to Nova Scotia.

Ontario.—Production of lead in Ontario declined more than 50 per cent in 1930. The principal producer is the Kingdon Mining, Smelting & Manufacturing Co., which operates a mine and smelter at Galetta. Production was suspended in May, 1931. Elsewhere in Ontario small quantities of lead were produced as a by-product of the smelting of silver-cobalt ores and from concentrates exported from the Errington mine of the Treadwell-Yukon Co. (Ltd.). The latter operated its mill up to November, 1930, treating 64,859 tons of ore containing 0.037 ounce of gold, 1.74 ounces of silver, 1.13 per cent copper, 1.25 per cent lead, and 4.19 per cent zinc. Besides copper and zinc concentrates 677 tons of lead concentrate was produced containing 32.21 per cent lead, 5.70 per cent zinc, 4.37 per cent copper, 24.17 ounces of silver, and 0.513 ounce of gold. Development work was started on the 1,500-foot level in an effort to find the downward extension of the ore body developed on the 500-foot level, but up to April 8, 1931, the extension had not been found.

Quebec.—No lead was produced in Quebec in 1930; in 1929 nearly 2,700 tons was produced. The output in 1929 was derived chiefly from the Tétreault mine at Notre Dame des Anges, which was closed down in December, 1929. During 1930 development work was continued, and it is probable that production will be resumed when metal prices improve.

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[6] Bell, J. M., The Genesis of the Lead-Zinc Deposits at Pine Point, Great Slave Lake: Econ. Geol., vol. 26, No. 6, September–October, 1931, pp. 611–624.

[7] Mifflen, S. C., Mining in Nova Scotia in 1930: Canadian Min. Jour., vol. 52, No. 2, Jan. 9, 1931, p. 38.

Yukon Territory.—Yukon Territory ranks second in Canadian lead production; it produced 4 per cent more lead in 1930 than in 1929. Most of the 1930 production, however, was mined and delivered to shipping points before the big drop in the price of silver. As the lead production is derived from ores valued chiefly for their silver content, the production for 1931 is expected to show a large decrease. The principal producer in the Province is the Treadwell-Yukon Co., which operates several mines in the Mayo district. In 1930 the company produced 4,169 tons of concentrates, containing 778 ounces of silver per ton and 49 per cent lead, and 2,272 tons of shipping ore, assaying 287 ounces of silver and 42 per cent lead. The prospecting and development activities of the company in the Mayo district have opened up little new ore, and the known ore reserves are sufficient for only 1 or 2 years of operation.

FRANCE

France produced 19,400 metric tons of lead in 1930, a decrease of 5 per cent from 1929. This output was only one-eighth of the country's consumption of lead, which was estimated at 155,800 tons in 1930. The lead-smelting industry of France is partly dependent upon imported ores, of which nearly 38,000 tons were imported; 22,000 tons of ore were exported in 1930. About 12,000 tons of argentiferous lead and 113,000 tons of nonargentiferous lead were imported in 1930, as compared with 12,000 and 74,000 tons, respectively, in 1929. In 1930 the argentiferous lead came chiefly from Greece and Turkey, whereas Spain supplied 37 per cent of the nonargentiferous lead, Mexico 28 per cent, Belgium 10 per cent, and Tunisia 9 per cent.

GERMANY

The smelter production of primary lead in Germany increased 13 per cent in 1930 to a postwar record of 110,800 metric tons. According to Metallgesellschaft, mine production increased from 52,700 tons in 1929 to 56,700 tons in 1930. The consumption of lead decreased from 212,400 tons to 165,300 tons so that imports of metallic lead decreased materially, from 137,000 tons in 1929 to 86,000 tons in 1930. Australia supplied 39 per cent of the 1930 imports, Mexico 28 per cent, and the United States 8 per cent. About 83,000 tons of lead ore were imported in 1930, Canada, Russia, Australia, and Sweden being the principal sources. Some lead ore is exported, chiefly from Upper Silesia, and most of it is sent to Polish smelters. About 32,000 tons of pig lead and 8,000 tons of pipes, sheets, etc., were exported in 1930.

The lead industry was adversely affected by low metal prices, and some of the mines were able to operate only by governmental help in the form of subsidies.

GREAT BRITAIN

Great Britain ranks second to the United States in consumption of pig lead; 284,000 long tons were consumed in 1930, an increase of 5 per cent over 1929. The smelting industry supplied only about 10,000 tons while imports amounted to 327,000 tons, of which 31 per cent was attributed to the United States, 31 per cent to Australia, and 13 per cent to Canada. The imports attributed to the United

States represent Canadian and Mexican shipments largely, as the reported exports from the United States to Great Britain amounted to only 8,200 tons. Exports of pig lead and sheets, pipes, etc., from Great Britain amounted to 11,000 tons in 1930.

Metallgesellschaft estimates the 1930 mine production of lead at 17,700 tons.

INDIA

The lead production of India in 1930 was slightly less than in 1929, amounting to 79,553 long tons or 5 per cent of the world total. Exports amounted to nearly 73,000 tons, of which Great Britain took 81 per cent, Japan 9 per cent, and Ceylon 4 per cent.

The only lead producer of any importance is the Burma Corporation (Ltd.). Its mines are at Bawdwin in the Upper Shan States of Burma. During the year ended June 30, 1930, the company mined 500,585 tons of ore averaging 21.5 per cent lead, 11.6 per cent zinc, 1.27 per cent copper, and 18.7 ounces of silver, bringing the total ore mined from the starting of operations to 3,616,103 tons. The metal output for the fiscal year was 79,267 tons of refined lead, 1,526 tons of refined antimonial lead, 7,254,780 ounces of silver, 58,335 tons of 52.36 per cent zinc concentrates, and 12,904 tons of copper matte. Ore reserves as of June 30, 1930, were estimated at 4,265,665 tons averaging 25.5 per cent lead, 15.3 per cent zinc, 20.4 ounces of silver, and 0.88 per cent copper, a substantial increase over the preceding year, notwithstanding the large quantity of ore mined during the year. The increase was due largely to the discovery of a 1,100-foot extension of the Chinaman ore body on the No. 2 level. Subsequent development of this extension will increase the reserve considerably.

A potential lead producer is the Bawzaing mine of the Shan States Silver-Lead Corporation (Ltd.), near Kalaw, southern Burma. At the end of 1930 a reserve of 200,000 tons of high-grade silver-lead ore was developed. A plant capable of treating 3,000 tons of ore per month has been built, but it is not operating owing to the unfavorable market.[8]

ITALY

Smelter production of lead in Italy increased slightly in 1930, amounting to 24,340 metric tons. Consumption amounted to 42,400 tons and imports to 18,000 tons. The mines of Italy produced 2,494 tons of lead concentrates containing 70 per cent lead and 47,434 tons of lead-silver concentrates containing 59 per cent lead, or a total lead content of 30,000 tons. The principal producing areas are the Iglesias district in the island of Sardinia and the Departments of Venezia Tridentina and Venezia Giulia. Early in 1931 it was reported[9] that the Italian cabinet had approved a proposal to subsidize the Sardinian lead and zinc mining industry, to avoid shutdowns and resultant unemployment.

JAPAN

Japan ranks fifth in world consumption of lead and is largely dependent upon imports. The estimated consumption in 1930 was 59,000 metric tons. Domestic production amounted to only 3,000 tons and imports amounted to 56,000 tons of which Canada supplied 43 per cent, United States 38 per cent, India 12 per cent, and Australia 6 per cent. Imports from the United States increased 14 per cent in 1930, while those from Canada decreased 24 per cent.

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[8] Engineering and Mining Journal, vol. 131, No. 10, May 25, 1931, p. 483.

[9] Mining Journal (London), vol. 173, No. 4994, May 9, 1931, p. 374.

MEXICO

Mexico has ranked second in world lead production for several years. In 1930 it produced 219,370 metric tons of pig lead, 13 per cent of the world total and 6 per cent less than its 1929 output. Mine production amounted to 232,931 tons, a decrease of 6 per cent as compared with 1929. More than half of the mine output comes from Chihuahua. Other leading producing States are Zacatecas, Coahuila, Durango, and San Luis Potosí.

The low price of metals caused many small mines to shut down during 1930. The lead smelter at Mazatlán and the Monterrey smelter of the American Smelting & Refining Co. were closed owing to a shortage of ore. The latter company constructed and put into operation a 300-ton mill at Chihuahua City for the treatment of lead carbonate ore. At Fresnillo reserves of lead-zinc-silver sulphide ore were greatly increased by development at depth, and the mill capacity was increased to 700 tons daily. At Santa Eulalia, Howe Sound increased its mill capacity to 2,000 tons daily but did not operate at full capacity. There was a decrease in production at the mines of the American Metal Co., and receipts of custom ore at the company's smelters declined. The San Francisco Mines of Mexico (Ltd.), operating lead-zinc-silver mines in Chihuahua, increased its milling-plant capacity from 300,000 to 400,000 tons per year.

Many producers were unable to obtain permission to shut down their properties and were thus forced to mine higher-grade ores and suspend exploration and development work to reduce costs. A new mining law which is said to contain several features more favorable to the mining companies than its predecessor was placed in effect in October, 1930.

Because of lowered rates given by American lines much lead previously exported from Tampico was diverted to Corpus Christi, Tex., for export. To regain this traffic for the National Railways, the Mexican Government authorized the Treasury Department to pay the difference between the existing rate to Tampico on the Mexican lines and the rate to Corpus Christi.

NEWFOUNDLAND

Lead concentrate is produced at the Buchans mine, owned jointly by the Anglo-Newfoundland Development Co. and the American Smelting & Refining Co During 1930 a total of 188,299 long tons of ore was milled, yielding 77,960 tons of lead and zinc concentrates, of which about one-third was lead concentrate. All the output in 1930 was shipped to Europe for smelting, but in 1931 some lead concentrate was being shipped to the United States. Mill capacity was being increased from 500 to 1,000 tons per day, and the erection of a lead smelter is being considered.

PERU

The smelter production of lead in Peru amounted to nearly 15,000 metric tons, a decrease of 23 per cent from 1929. The lead is produced in the form of base bullion, most of which is refined in the United States. The largest producer is the Cerro de Pasco Copper Corporation, which is reported to have produced 13,962 tons in 1930 and 17,952 tons in 1929. Its principal source of lead is the Casapalca lead-zinc mine. This company was forced to suspend operations for a time during 1930 owing to riots accompanying the revolution. During the latter part of the year operations were suspended at the lead smelter and the Casapalca mine owing to low metal prices. All new construction has been temporarily discontinued.

RUSSIA

Consumption of lead in Russia has increased from 22,000 metric tons in 1926 to 59,000 tons in 1930; but there has been little progress in production, the 1930 output amounting to only 4,500 tons as compared with 6,200 tons in 1929. Imports increased from 44,000 to 50,000 tons. Some lead ore was exported in 1930.

Owing to low metal prices the only privately operated lead-zinc property in Russia was unable to operate profitably. In August, 1931, shareholders of the Tetiuhe Mining Corporation were asked to authorize the directors of the corporation to conclude negotiations for the termination of the concession and the return of its properties to the Soviet Government. A lead smelter was built at the property recently.

According to V. Karmashov [10] the Soviet 5-year plan anticipates a production of 14,000 tons of lead in 1931 and 116,000 tons in 1933. Consumption in 1933 is estimated at 221,000 tons. A later official publication [11] states that the second 5-year plan calls for a production of 438,000 tons in 1935 and 717,000 tons in 1937.

Except for the Tetiuhe plant there is at present no smelter in Russia capable of producing lead on a large scale, but according to Karmashov several new plants are under construction or are being planned. These include the Nerchinsk-Kemerovo lead-zinc plant with an annual capacity of 20,000 tons of lead, the Chimkent-Turlan lead plant (50,000 tons), and the Vladikavkas lead-zinc plant (10,000 tons), and a lead-refining plant (30,000 tons) at Moscow presumably to operate on secondary materials. The Ridder and Alagir lead smelters are to be increased to 18,000 and 5,000 tons annual capacity, respectively.

SOUTH-WEST AFRICA [12]

The principal source of lead production in South-West Africa is the Tsumeb mine, in the north-central part of the country, 354 miles (by rail) northeast of the port of Swakopmund. The ore body is a replacement deposit surrounding an aplite stock intruded into a zone of fracture in dolomite. At the surface the deposit had a length of about 550 feet and a maximum width of 45 feet, and it thinned out toward either end. The strike is approximately east and west, and the stock dips steeply to the south. The deposit was worked (by open-cast methods) to a depth of about 160 feet. Thereafter underground methods were employed. At present development has continued to a depth of 2,000 feet, and ore is being mined below 1,600 feet.

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[10] Karmashov, V., The Mining Industry of U. S. S. R.: Eng. and Min. Jour., vol. 131, No. 3, Feb. 9, 1931, p. 132.

[11] Russian Economic Notes, U. S. Dept. of Commerce, No. 142, July 31, 1931, p. 1.

[12] Clark, A. W., The Ore Deposits of the Otavi Mountains, South-West Africa: Min. Mag. (London), vol. 44, No. 5, May, 1931, p. 265.

The ore below the oxidized zone consists of a coarsely crystalline aggregate of chalcocite, galena, tetrahedrite, zinc blende, pyrite, and enargite, and, in the lower levels, chalcopyrite and bornite. It is noted for its high metal content. Between the 500 and 1,500 foot levels the ore body (exclusive of the aplite stock) is estimated to contain a total of 45 to 50 per cent of copper, lead, and zinc; the copper content averages 7 to 9 per cent, lead 26 to 28 per cent, and zinc 13 to 15 per cent. At present the richest ore, carrying over 10 per cent copper, is shipped direct to Europe. The rest of the ore is treated in the smelter at the mine and yields a matte containing 40 to 50 per cent copper, about 20 per cent lead, and some silver, and pig lead containing about 30 ounces of silver. Some cadmium is recovered, but the zinc is dumped with the slags. During the year ended March 31, 1931, the ore production from the Tsumeb mine was 215,000 short tons. The following products were exported: 43,000 tons of ore containing 12.8 per cent copper, 28.6 per cent lead, and 8.87 ounces of silver per ton; 15,036 tons of matte averaging 44.8 per cent copper, 22.8 per cent lead, and 24.53 ounces of silver; and 3,661 tons of pig lead averaging 96.3 per cent lead and 36.88 ounces of silver. The exported products contained 12,240 tons of copper, 19,252 tons of lead, and 885,261 ounces of silver.

In July, 1931, the mine was closed down owing to low metal prices.

SPAIN

Spain fell to fifth place in world production of lead in 1930 as a result of a 14 per cent decrease in output; a total of 123,000 metric tons was produced in 1930, as compared with 143,000 tons in 1929. The 1930 output was 7 per cent of the world total. Exports amounted to 89,000 tons in 1930, as compared with 97,000 tons in 1929. Mine production declined from 181,000 tons of ore and concentrates in 1929 to 164,000 tons in 1930. The principal mines are in the Provinces of Jaén, Córdoba, Murcia, Ciudad Real, and Santander. The smelting industry is largely in Murcia, Córdoba, and Jaén.

The low price of lead prevailing in 1930 resulted in the closing down of many small mines. Only the larger and richer mines were able to continue production. The low exchange value of the peseta during 1930 offset to some extent the low price of lead for lead-exporting companies.

TUNISIA

Tunisia produced 19,500 metric tons of pig lead in 1930, as compared with 18,850 tons in 1929. Production of lead ore decreased from 31,000 tons in 1929 to 27,500 tons in 1930, the latter averaging 53 per cent lead. Most of the lead ore is smelted at home. The Djebel Hallouf smelter produced 15 per cent of the total in 1930, and the Mégrine smelter produced 85 per cent. The former operates on ores from its own mines, whereas the latter imports some foreign ore. During the first nine months of 1930, a total of 5,700 tons of ore was imported from France, Algeria, and Greece. Exports of pig lead amounted to 15,241 tons in 1930 and 19,067 tons in 1929.

YUGOSLAVIA

Smelter production of lead in Yugoslavia increased slightly in 1930, amounting to about 10,000 metric tons. Consumption was estimated at 7,500 tons, leaving a small export surplus. This country now produces important quantities of lead-zinc ore as a result of the beginning of milling operations at the Stantrg mine of Trepca Mines (Ltd.) on August 20, 1930. Up to the end of 1930 the company had treated 75,098 tons of ore containing 13.3 per cent lead and 7.6 per cent zinc, from which were produced 13,190 tons of lead concentrates, containing 72.6 per cent lead and 27 ounces of silver per ton, and 8,365 tons of 48.7 per cent zinc concentrates. At the close of the year the calculated mill recovery was 97 per cent of the lead and 83 per cent of the zinc. The mill, which was originally designed to treat 500 tons per day, was treating 700 tons at the end of the year. Other lead-zinc deposits in Yugoslavia were being investigated in 1930.

IMPORTS

The United States imports much lead in various forms, principally in base bullion and ore. Some of it is entered for immediate consumption; most of it, however, is entered for warehouse, is smelted and refined in bond, and is then reexported as refined pig lead or in manufactured products.

GENERAL IMPORTS

The following table shows the general imports of lead into the United States, by classes, including both imports for immediate consumption and imports for warehouse. Of the total lead imported in 1930, as shown in the table, 50.3 per cent was in ore, 49.4 per cent in base bullion, and 0.3 per cent in pigs, bars, sheets, and old. Imports in base bullion and in pigs, bars, etc., decreased 53 and 87 per cent, respectively, while imports in ore increased 26 per cent. Total imports of lead decreased 33 per cent in 1930.

Lead imported into the United States, 1921–1930, by classes, in pounds

[General imports]

Year	Lead in ore	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1921	14, 234, 039	71, 733, 838	62, 602, 534	148, 570, 411
1922	24, 474, 481	124, 074, 465	7, 101, 623	155, 650, 569
1923	66, 882, 850	161, 496, 495	42, 198, 848	270, 578, 193
1924	95, 320, 168	155, 501, 350	24, 493, 746	275, 315, 264
1925	88, 962, 502	141, 253, 559	14, 042, 369	244, 258, 430
1926	116, 232, 669	156, 570, 738	22, 304, 620	295, 108, 027
1927	81, 276, 126	236, 567, 252	4, 934, 749	322, 778, 127
1928	51, 829, 530	256, 935, 461	1, 323, 158	310, 088, 149
1929	62, 661, 371	166, 141, 916	3, 315, 481	232, 118, 768
1930	78, 753, 878	77, 260, 580	418, 906	156, 433, 364

General imports of lead by countries are shown in the next table. Mexico supplied 47 per cent of the total, South America (principally Peru) 29 per cent, Canada 22 per cent, and Europe and other countries 2 per cent. Imports from Mexico and South America decreased 58 and 4 per cent, respectively, while imports from Canada increased 283 per cent. The decrease from Mexico was due to a large decline in imports of base bullion, while the increase from Canada was due to higher imports of lead in ore.

Lead imported into the United States, in ore, base bullion, and refined, 1921–1930, by sources, in pounds

[General imports]

Year	Canada	Mexico	South America	Europe	Other countries	Total
1921	8, 127, 158	106, 406, 238	2, 381, 365	30, 224, 701	1, 430, 949	148, 570, 411
1922	8, 663, 236	141, 216, 136	3, 803, 478	1, 454, 384	513, 335	155, 650, 569
1923	11, 399, 671	242, 352, 788	5, 300, 161	11, 004, 938	520, 635	270, 578, 193
1924	11, 022, 091	243, 161, 069	15, 820, 867	4, 857, 805	453, 432	275, 315, 264
1925	11, 646, 820	218, 873, 800	10, 621, 737	1, 594, 963	1, 521, 110	244, 258, 430
1926	12, 316, 740	254, 203, 852	24, 790, 075	3, 224, 504	572, 856	295, 108, 027
1927	6, 214, 867	300, 634, 815	14, 583, 513	1, 226, 049	118, 883	322, 778, 127
1928	14, 352, 967	275, 184, 287	20, 408, 574	56, 406	85, 915	310, 088, 149
1929	9, 023, 527	175, 872, 302	47, 052, 018	29, 441	141, 480	232, 118, 768
1930	34, 536, 897	73, 442, 591	44, 943, 694	226, 294	3, 283, 888	156, 433, 364

The following tables show the imports of lead in ore, matte, and base bullion, by countries.

Lead imported into the United States, in ore and matte, 1926–1930, by countries, in short tons

[General imports]

Country	1926	1927	1928	1929	1930
Mexico	40, 239	30, 615	17, 055	23, 415	16, 341
Canada	5, 524	2, 558	7, 131	3, 953	17, 257
Peru	3, 642	3, 415	1, 170	1, 601	831
Chile	7, 596	3, 877	504	2, 295	3, 313
Other countries	1, 115	173	55	67	1, 635
	58, 116	40, 638	25, 915	31, 331	39, 377

Imports of lead in ore from Mexico decreased 30 per cent in 1930, amounting to 41 per cent of the total. Imports from Canada increased 337 per cent and those credited to Chile 44 per cent, while imports from Peru decreased to about one-half those in 1929. The increase in imports from "other countries" was due to shipments from Japan. A large part of the ore credited to Chile probably originated in Bolivia and shipments from Japan were largely ore mined in Siberia.

Lead imported into the United States, in base bullion, 1926–1930, by countries, in short tons

[General imports]

Country	1926	1927	1928	1929	1930
Mexico	77, 663	117, 938	119, 935	63, 458	20, 350
Peru	435	--------	8, 525	19, 605	18, 280
Spain	--------	336	--------	--------	--------
Other countries	187	10	8	8	--------
	78, 285	118, 284	128, 468	83, 071	38, 630

Imports of base bullion from Mexico in 1930 were 68 per cent less than in 1929 and 83 per cent less than in 1928. The decrease was due to the completion of additional refinery capacity during 1929, which permitted an increase in the quantity of refined lead produced in Mexico. Imports from Peru were almost as large as in 1929.

IMPORTS FOR CONSUMPTION

Statistics on imports for consumption, as shown in the tables that follow, include imports entered for immediate consumption and withdrawals from warehouse for domestic consumption. As most of the lead imported is smelted and refined in bond and reexported the total imported for consumption is considerably less than general imports. In 1930 imports for consumption were equivalent to only about 34 per cent of the general imports of lead.

Lead remaining in warehouse in the United States, December 31, 1921–1930, in pounds

[Stated in the form in which the material was entered for warehouse]

Year	Ore (lead content)	Base bullion (lead content)	Pigs, bars, and old	Year	Ore (lead content)	Base bullion (lead content)	Pigs, bars, and old
1921	13, 679, 465	24, 692, 350	693, 440	1926	114, 630, 697	107, 582, 653	[1] 21, 820, 057
1922	10, 470, 144	7, 076, 544	----------	1927	99, 526, 339	126, 669, 674	[1] 19, 326, 011
1923	76, 031, 259	80, 306, 856	5, 234, 475	1928	97, 645, 207	137, 500, 524	8, 278, 733
1924	103, 474, 370	95, 007, 016	10, 090, 668	1929	120, 413, 999	150, 868, 776	2, 656, 648
1925	105, 884, 711	91, 725, 008	[1] 16, 565, 672	1930	79, 031, 855	[2] 11, 283, 785	(2)

[1] Includes lead in reclaimed scrap, as follows: 1925, 241,078 pounds; 1926, 397,433 pounds; 1927, 397,712 pounds. Corresponding figures for earlier years and for 1928 and 1929 are not recorded separately.

[2] Pigs, bars, and old included with base bullion; not recorded separately for 1930.

Lead imported for consumption in the United States, 1921–1930, by classes

Year	Lead in ore [1]		Lead in base bullion		Pigs, bars, and old [2]		Sheets, pipe, and shot		Not otherwise specified	Total value
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value		
1921	6, 842, 807	$327, 046	56, 819, 980	$1, 668, 410	61, 909, 094	$1, 972, 716	3, 087	$140	$11, 204	$3, 979, 516
1922	23, 649, 851	812, 603	55, 859, 422	1, 815, 142	8, 563, 110	335, 924	6, 018	697	12, 286	2, 976, 652
1923	22, 420, 046	1, 190, 414	11, 124, 151	626, 201	42, 925, 265	2, 510, 466	19, 525	4, 495	90, 027	4, 421, 603
1924	65, 147, 976	3, 145, 791	28, 796, 402	1, 542, 167	27, 362, 392	1, 850, 862	11, 666	4, 384	138, 637	6, 681, 841
1925	12, 706, 508	672, 112	24, 747, 665	1, 823, 566	15, 464, 205	1, 038, 350	27, 579	10, 429	139, 533	3, 683, 990
1926	58, 752, 911	3, 393, 039	13, 341, 038	972, 758	24, 365, 570	2, 191, 658	864, 342	101, 322	62, 895	6, 721, 672
1927	70, 260, 478	4, 203, 897	14, 629, 606	925, 328	9, 933, 679	635, 807	988, 170	104, 890	52, 626	5, 922, 548
1928	46, 511, 508	2, 626, 231	13, 397, 455	560, 983	20, 488, 373	808, 359	775, 329	67, 131	134, 995	4, 197, 699
1929	21, 645, 699	1, 160, 533	12, 395, 696	627, 455	20, 178, 922	1, 052, 087	899, 595	78, 776	126, 966	3, 045, 817
1930	30, 915, 964	1, 461, 350	20, 846, 713	1, 127, 920	1, 141, 442	60, 493	908, 809	78, 737	87, 612	2, 816, 112

[1] Includes also lead in matte beginning Sept. 22, 1922.

[2] Includes also imports of antimonial lead, antimonial scrap lead, babbitt metal, solder, etc., beginning with tariff of Sept. 22, 1922, except in 1925 to 1930, inclusive, when antimonial lead is excluded.

Type metal [1] imported for consumption in the United States, 1921–1930

Year	Type metal		Lead content	
	Pounds	Value	Pounds	Percentage
1921	38, 971, 351	$1, 191, 553	30, 706, 845	78. 8
1922	44, 895, 120	1, 120, 814	33, 944, 199	75. 6
1923	(2)	431, 610	7, 353, 463	(2)
1924	(2)	100, 367	1, 288, 766	(2)
1925 [1]	6, 009, 161	463, 134	4, 309, 549	71. 7
1926 [1]	8, 621, 175	912, 331	7, 053, 849	81. 8
1927 [1]	878, 346	65, 049	666, 654	75. 9
1928 [1]	3, 990, 548	193, 177	3, 086, 770	77. 4
1929 [1]	5, 440, 857	180, 679	4, 849, 979	89. 2
1930 [1]	656, 841	32, 934	550, 444	83. 8

[1] Classification for 1925 to 1930 is "Type metal and antimonial lead"; separate figures not recorded.

[2] Figures not available.

EXPORTS

The chief lead export of the United States is refined pig lead derived from the treatment of foreign ores and base bullion. Exports decreased 34 per cent in 1930 owing primarily to a 53 per cent decrease in imports of base bullion. Europe took 58 per cent of the total, Asia 36 per cent, South America 5 per cent, and North America and Africa 1 per cent. Exports to Asia almost equaled those in 1929; the falling off of exports to Europe accounted for most of the total decrease. In Europe the United Kingdom, Sweden, Denmark, and France were the largest importers; in Asia and South America, Japan and Argentina, respectively, ranked first. Japan took 32 per cent and the United Kingdom 19 per cent of the total United States exports.

Refined pig lead exported from the United States, 1929 and 1930, by destinations

Destination	1929		1930	
	Short tons	Value	Short tons	Value
North America:				
Canada	141	$24, 662	9	$1, 262
Cuba	248	27, 899	107	10, 952
Mexico	83	16, 696	40	6, 454
Panama	52	6, 981	91	10, 540
Other	169	29, 107	71	8, 500
	693	105, 345	318	37, 708
South America:				
Argentina	599	57, 845	934	75, 400
Brazil	1, 538	154, 135	874	65, 542
Chile	989	112, 220	224	21, 673
Colombia	93	13, 481	25	3, 071
Ecuador	33	4, 465	(1)	91
Peru	88	8, 693	11	1, 286
Uruguay	448	43, 248	364	30, 242
Other	64	7, 318	10	1, 271
	3, 852	401, 405	2, 442	198, 576
Europe:				
Belgium	896	92, 085	576	61, 915
Denmark	4, 322	419, 031	5, 205	398, 165
France	2, 202	205, 009	3, 001	239, 444
Germany	9, 745	945, 460	823	68, 755
Italy	103	9, 700	532	41, 070
Netherlands	1, 522	149, 812	22	2, 200
Sweden	7, 255	708, 255	7, 557	601, 335
United Kingdom	23, 732	2, 295, 238	9, 157	710, 080
Other	872	84, 945	1, 026	79, 662
	50, 649	4, 909, 535	27, 899	2, 202, 626
Asia:				
China	813	78, 439	953	78, 843
Japan	16, 416	1, 594, 706	15, 653	1, 293, 142
Philippine Islands	111	14, 417	543	49, 208
Other	715	74, 154	140	11, 310
	18, 055	1, 761, 716	17, 289	1, 432, 503
Africa	2	215	358	32, 557
Oceania:				
Australia			1	243
French	(1)	121		
	73, 251	7, 178, 337	48, 307	3, 904, 213

[1] Less than 1 ton.

The following table shows the exports of lead from the United States from 1921 to 1930. Of the lead exported with benefit of drawback in 1930 miscellaneous lead manufactures (principally lead foil) accounted for 21.9 per cent, white lead 38.9 per cent, red lead 20.5 per cent, babbitt 2.9 per cent, lead-covered cable 4.8 per cent, type metal 2.6 per cent, shot shells 1.9 per cent, and others 6.5 per cent.

Refined lead exported from the United States, 1921–1930

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of drawback (short tons)
	Short tons	Value	
1921	26,624	$2,462,033	9,369
1922	38,178	3,781,965	5,677
1923	50,735	5,455,743	12,526
1924	82,090	10,396,766	15,275
1925	103,519	15,695,331	11,699
1926	71,936	$9,505,664	17,955
1927	125,267	12,817,264	12,004
1928	116,269	10,359,221	13,224
1929	73,251	7,178,337	13,086
1930	48,307	3,904,213	12,161

CONSUMPTION

REFINED PRIMARY PIG LEAD AVAILABLE FOR DOMESTIC CONSUMPTION

The manufacturing industry of the United States consumes lead in four main forms; namely, refined primary pig lead, primary antimonial lead, primary lead in the form of ore, and secondary lead. The following table shows the refined primary pig lead available for consumption from 1925 to 1930.

Refined primary pig lead available for consumption in the United States, 1925–1930, in short tons

	1925	1926	1927	1928	1929	1930
Supply:						
Stock in bonded warehouse Jan. 1	5,045	8,162	10,711	9,464	4,139	1,328
Imports of pigs, bars, and old [1]	7,021	11,152	2,467	662	1,658	209
Production	766,969	798,941	796,530	781,071	774,633	643,033
	779,035	818,255	809,708	791,197	780,430	644,570
Withdrawn:						
Exports—						
Pig lead	103,519	71,936	125,267	116,269	73,251	48,307
In manufactures, with benefit of drawback	11,699	17,955	12,004	13,224	13,086	12,161
Stock in bonded warehouse Dec. 31	8,162	10,711	9,464	4,139	1,328	(2)
	123,380	100,602	146,735	133,632	87,665	61,796
Supply available for consumption	655,655	717,653	662,973	657,565	692,765	582,774

[1] Includes 622 tons of "old, reclaimed, and scrap" in 1925 and 1,135 tons in 1926. Corresponding figures for other years not separately recorded.

[2] Figures not available. For purpose of calculating quantity available for domestic consumption, stocks in warehouse are estimated to have remained unchanged from the beginning of the year.

The foregoing table is intended to include only primary lead or lead smelted directly from ore. There are, however, some small discrepancies which should be pointed out. Many primary lead smelters produce from secondary materials some lead that is inseparable from the primary lead in the final product. Exports of lead as reported above may therefore contain some secondary lead. There are also some inaccuracies in the statistics of imports, exports, and warehouse transactions. Nevertheless, on the basis of the data available, the table gives approximately the quantity of new refined lead available to American industry each year. As the table does not consider fluctuations in producers' and consumers' stocks, it indicates the trend of consumption only in a general way.

CONSUMPTION BY USES

The quantity of lead in all forms consumed by American industry is estimated each year by the American Bureau of Metal Statistics. The following table is quoted in full from the 1930 yearbook of that bureau.

Lead consumed in the United States,[1] 1922–1930, in short tons

Purpose	1922	1923	1924	1925	1926	1927	1928	1929	1930
White lead [2]	156,000	130,000	150,000	131,000	120,000	126,000	123,000	119,700	83,900
Red lead and litharge [3]	30,000	46,000	34,000	42,000	36,000	38,000	31,000	30,000	32,000
Storage batteries [4]	130,000	143,000	170,000	180,000	190,000	175,000	220,000	210,000	163,000
Cable covering [4]	93,000	131,000	138,000	156,000	185,000	161,000	180,000	206,000	195,000
Building [5]	71,000	75,000	83,100	88,400	93,700	88,000	96,000	96,000	67,000
Automobiles [5]	7,200	10,400	10,700	12,800	16,700	12,000	17,000	18,000	11,000
Railway equipment [6]	3,350	8,100	5,600	5,200	4,800	3,350	2,500	5,700	5,200
Shipbuilding [5]	100	100	200	100	100	200	100	300	500
Ammunition [4]	38,000	40,000	27,000	31,500	32,000	34,000	39,600	41,100	33,300
Terneplate [4]	4,700	4,600	4,050	4,500	4,100	3,900	4,400	4,200	2,700
Foil [4]	26,800	33,300	35,000	32,500	35,000	30,000	35,000	30,000	24,000
Bearing metal [6]	26,000	28,000	32,000	34,000	36,000	31,000	32,000	33,000	20,000
Solder [7]	20,000	30,000	30,000	35,000	37,000	35,000	37,000	37,000	27,000
Type metal [7]	9,500	12,000	13,000	15,000	16,000	16,000	17,000	18,000	16,000
Calking [7]	20,000	25,000	26,500	30,000	32,000	30,000	32,000	31,500	21,000
Castings [7]	15,000	15,000	15,000	18,000	18,000	17,000	18,000	18,000	12,000
Other uses [8]	32,500	36,500	38,000	40,500	44,500	40,500	46,000	50,000	40,000
Total	683,150	768,000	812,150	856,500	900,900	840,950	930,600	948,500	753,600

[1] Source: American Bureau of Metal Statistics. These estimates are for the total consumption of lead, irrespective of whether its origin be primary or secondary. Antimonial lead is included and the manufacture of lead for export under drawback provisions is included.

[2] From data of sales reported by U. S. Bureau of Mines up to 1928. Later figures have been determined by an improved method.

[3] Exclusive of oxides for storage batteries.

[4] Based on reports from a large proportion of manufacturers in each industry.

[5] Based on estimates of manufacture and the quantity of lead used per unit of manufacture. Under the head of building is included the lead used in chemical construction.

[6] Based on the estimated consumption of lead for this purpose by the railways.

[7] Estimates of persons engaged in the trades.

[8] Conjectural.

According to the foregoing table the lead consumed in the United States in 1930 amounted to 753,600 tons, which is less than that consumed in any year since 1922. In the following table the individual uses of lead have been arranged according to their percentage relation to the total lead consumed in 1930.

Percentage of total lead consumed in the United States, 1925–1930, by uses

Use	1925	1926	1927	1928	1929	1930
Cable coverings	18.21	20.53	19.15	19.34	21.72	25.88
Storage batteries	21.02	21.09	20.81	23.64	22.14	21.63
White lead	15.29	13.32	14.98	13.22	12.63	11.13
Building	10.32	10.40	10.46	10.32	10.12	8.89
Ammunition	3.68	3.55	4.04	4.26	4.33	4.42
Litharge and red lead	4.90	4.00	4.52	3.33	3.16	4.25
Solder	4.09	4.11	4.16	3.98	3.90	3.58
Foil	3.80	3.89	3.57	3.76	3.16	3.18
Calking	3.50	3.55	3.57	3.44	3.32	2.79
Bearing metal	3.97	4.00	3.69	3.44	3.48	2.65
Type metal	1.75	1.78	1.90	1.83	1.90	2.12
Castings	2.10	2.00	2.02	1.93	1.90	1.59
Automobiles	1.49	1.85	1.43	1.83	1.90	1.46
Railway equipment	.61	.53	.40	.26	.60	.69
Terneplate	.53	.45	.46	.47	.44	.36
Shipbuilding	.01	.01	.02	.01	.03	.07
Miscellaneous	4.73	4.94	4.82	4.94	5.27	5.31

From 1923 to 1929 storage batteries were the largest consumer of lead, but in 1930 cable coverings required more lead than any other use due to the fact that the decline in the storage-battery industry in 1930 was much more pronounced than that in the lead-cable industry. The quantity of lead used in the manufacture of storage batteries declined 22 per cent, while that used in cable covering declined only 5 per cent.

The use of lead as a protective coating for copper-wire cables employed chiefly in telephone and underground transmission lines appears sure to increase. General expansion of the use of electrical power, such as the large electrification programs announced by some of the railway companies and the development of the Boulder Dam and other great power projects, will require large amounts of lead-covered cable. Increasing civic consciousness will undoubtedly result in placing many of the present unsightly overhead telephone and transmission lines underground, as has been the custom in Washington, D. C., for many years. Research work now in progress to determine the causes and remedies of certain defects in lead-covered cable that have limited its use in some industries should yield profitable results in expanding the market for lead-covered cable.

Storage batteries are used chiefly in motor vehicles; consequently, the decreased production in the automotive industry was reflected in smaller requirements of lead for the manufacture of storage batteries. The production of batteries for automobiles, however, did not suffer a decline proportionate to that suffered by the automotive industry, largely because of the battery replacements required for cars already in service. The American Bureau of Metal Statistics has estimated the production of automobile storage batteries at 13,000,000 in 1930 and 16,000,000 in 1929. Exports of storage batteries have grown steadily from a total of about 207,000 in 1925 to 399,000 in 1930, an increase of 93 per cent. Until 1930, the expansion of the automobile industry and export trade had more than offset the decreased use of storage batteries in radios, which resulted from the introduction of "socket power" sets. The American Bureau of Metal Statistics has estimated that about 60,000 radio storage batteries were manufactured in 1930, as compared with 170,000 in 1929 and 400,000 in 1928.

The manufacture of white lead is the third largest use of lead, but one that appears to be on the decline. Prior to 1923 this industry was the largest consumer of lead and in 1922 took 156,000 tons or 23 per cent of the total estimated lead consumption. In 1930 only 83,900 tons (11.1 per cent of the total) were so used. The declining use of white lead is due to the substitution in paints of the cheaper pigments, principally lithopone and zinc oxide, and to the increased use of nitrocellulose paints in which white lead is seldom used on account of its chemical instability in contact with nitrocellulose products.

F. E. Wormser, secretary of the Lead Industries Association, has summarized developments in the uses of lead as follows: [13]

> So far as the industrial applications of lead are concerned it is interesting to observe that more data were forthcoming during 1930 to show that the new lead-calcium alloy developed for cable sheathing promises to find a place in toll cable construction, if not ultimately in power cables as well, although power cable fabricators have not, as a rule, turned to any alloy of lead, preferring common lead for their use. The lead-calcium alloy would naturally displace the widely used antimony-lead combination, if it is finally adopted as standard on toll lines. I understand trial sections of lead-calcium sheathed cable are still being tested experimentally.
>
> During 1930 the use of lead-asbestos antivibration mattresses under the column footings of huge buildings made further progress. In fact, the application of this device has been extended to moving machinery such as printing presses and rubber machinery. In some cases other nonmetallic vibration dampening substances are used in place of asbestos and enclosed in sheet lead.
>
> An interesting revival of an ancient use of lead occurred in 1930—the manufacture of an all lead casket (hard lead). In view of the renowned corrosion resisting quality of lead one wonders why this metal has not been more widely used for sepulchral equipment other than casket hardware.
>
> Recent British research has tended to show that, contrary to popular impression, the presence of antimony up to 3 per cent is not an objectionable constituent of lead-tin solder but is generally advantageous, although it is objectionable when soldering zinc or galvanized iron.
>
> A stream-line fitting for copper tubing using a solder film was placed upon the market in 1930.

PRICES

The two major markets for lead in the United States are at New York and St. Louis, and a large part of the lead produced in the United States is sold at prices based on the quotations in these two markets. The New York quotations are influenced to some extent by the lower prices usually prevailing on the London market, so that the New York price seldom exceeds the St. Louis price by as much as the freight differential, 0.35 cent a pound.

The following tables show the average monthly quoted prices of lead at St. Louis, New York, and London for 1928, 1929, and 1930, and the average yearly prices from 1910 to 1930.

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[13] Wormser, F. E., Lead: Metal Ind., vol. 29, No. 1, January, 1931, p. 7.

Average monthly quoted prices of lead at St. Louis, New York, and London, 1928–1930, in cents per pound[1]

Month	1928			1929			1930		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	6. 29	6. 50	4. 74	6. 50	6. 65	4. 79	6. 10	6. 25	4. 68
February	6. 08	6. 34	4. 41	6. 73	6. 86	5. 01	6. 09	6. 24	4. 60
March	5. 82	6. 02	4. 34	7. 38	7. 50	5. 50	5. 56	5. 67	4. 08
April	6. 00	6. 11	4. 42	7. 03	7. 20	5. 37	5. 43	5. 53	4. 09
May	6. 02	6. 13	4. 46	6. 77	7. 00	5. 19	5. 41	5. 51	3. 86
June	6. 16	6. 30	4. 57	6. 80	7. 00	5. 13	5. 31	5. 39	3. 89
July	6. 05	6. 22	4. 47	6. 61	6. 80	4. 94	5. 15	5. 23	3. 94
August	6. 05	6. 25	4. 68	6. 55	6. 75	5. 02	5. 33	5. 49	3. 98
September	6. 29	6. 45	4. 77	6. 69	6. 89	5. 10	5. 35	5. 49	3. 89
October	6. 32	6. 50	4. 78	6. 67	6. 87	5. 05	5. 00	5. 15	3. 42
November	6. 23	6. 39	4. 60	6. 13	6. 29	4. 71	4. 95	5. 10	3. 45
December	6. 34	6. 50	4. 62	6. 10	6. 25	4. 68	4. 95	5. 10	3. 31

[1] St. Louis: Metal Statistics, 1931, p. 377. Average daily quotations of soft Missouri lead, f. o. b. St. Louis (open market), as reported daily in the American Metal Market.
New York: American Metal Market, daily issues. Pig lead, New York (outside market) prompt shipment from West.
London: Metal Statistics, 1931, p. 381. Average price of foreign lead. Price per long ton, as published in Metal Statistics, converted to cents per pound at average exchange rate reported by the Federal Reserve Board.

Average yearly prices of lead at St. Louis, New York, and London, 1910–1930

Year	St. Louis[1] (per pound)	New York[2] (per pound)	London[3]		New York excess (+) or London excess (−) (per pound)[4]
			Per long ton	Per pound	
	Cents	*Cents*		*Cents*	*Cents*
1910	4. 33	4. 49	£12. 950	2. 81	+1. 68
1911	4. 31	4. 46	13. 463	2. 92	+1. 54
1912	4. 38	4. 48	17. 792	3. 87	+. 61
1913	4. 26	4. 40	18. 308	3. 98	+. 42
1914	3. 74	3. 87	18. 688	4. 09	−. 22
1915	4. 57	4. 67	22. 883	4. 85	−. 18
1916	6. 80	6. 83	30. 975	6. 58	+. 25
1917	8. 92	8. 71	30. 000	6. 37	+2. 34
1918	7. 25	7. 46	30. 133	6. 40	+1. 06
1919	5. 55	5. 81	28. 196	5. 57	+. 24
1920	7. 93	8. 08	38. 229	6. 25	+1. 83
1921	4. 39	4. 55	22. 725	3. 90	+. 65
1922	5. 52	5. 71	23. 742	4. 69	+1. 02
1923	7. 35	7. 25	26. 817	5. 48	+1. 77
1924	8. 10	8. 08	33. 696	6. 64	+1. 44
1925	8. 92	9. 02	35. 863	7. 73	+1. 29
1926	8. 25	8. 42	31. 075	6. 74	+1. 68
1927	6. 52	6. 75	24. 192	5. 25	+1. 50
1928	6. 14	6. 31	21. 058	4. 58	+1. 73
1929	6. 66	6. 83	23. 246	5. 04	+1. 79
1930	5. 38	5. 52	18. 075	3. 92	+1. 60

[1] Compiled from daily quotations in open market at St. Louis, as published in Metal Statistics, 1931, p. 375.

[2] Average prices based on quotations of American Smelting & Refining Co., as published in Metal Statistics, 1931, p. 369.

[3] Prices of foreign lead in London, as published in Metal Statistics, 1931, p. 381, converted to cents per pound on basis of average exchange rates published in the reports of the Federal Reserve Board.

[4] Import duties on refined pig lead have been as follows: Aug. 6, 1909, to Oct. 3, 1913—2⅛ cents per pound. Oct. 4, 1913, to Sept. 21, 1922—25 per centum ad valorem; average tariff collected—1⅒ cents per pound. Sept. 22, 1922, to date (1930)—2⅛ cents per pound.

To facilitate the settlement of its buying and selling contracts for lead the American Smelting & Refining Co., which controls a large part of the United States lead production, at frequent intervals publishes an official contract price based on the New York market. The following are the company's quotations for 50-ton lots, f. o. b. New York, in 1929 and 1930, in cents per pound.

1929		1930	
Jan. 2	6.65	Feb. 27	6.10
Feb. 6	6.75	Mar. 3	6.00
Feb. 11	6.85	Mar. 6	5.85
Feb. 19	6.95	Mar. 7	5.75
Feb. 27	7.10	Mar. 8	5.60
Mar. 6	7.25	Mar. 10	5.50
Mar. 19	7.50	Mar. 25	5.65
Mar. 20	7.75	Mar. 26	5.75
Apr. 4	7.50	Apr. 4	5.60
Apr. 8	7.25	Apr. 7	5.50
Apr. 10	7.15	May 13	5.60
Apr. 15	7.00	May 20	5.50
July 5	6.90	June 17	5.40
July 10	6.75	June 23	5.25
Sept. 5	6.90	Aug. 1	5.35
Oct. 29	6.75	Aug. 4	5.50
Oct. 31	6.50	Oct. 1	5.35
Nov. 6	6.35	Oct. 4	5.25
Nov. 7	6.25	Oct. 8	5.20
		Oct. 9	5.15
		Oct. 10	5.10

The price of lead in 1930 continued the downward trend which began in April, 1929, and by the end of the year it had declined to the lowest level since the early part of 1922. The New York quotation on January 2, 1930, and the average for that month was 6.25 cents per pound. This price was maintained until the last few days in February when weakness in the European market caused a downward trend in prices, which continued with few interruptions until July when the quotation was stabilized for a time at 5.25 cents. In August and September the price was maintained at a higher level because of more active demand; but early in October it fell to 5.10 cents, where it remained throughout the rest of the year. The drop from 6.25 to 5.10 cents, the high and the low for the year, represented a decrease of 18 per cent. The average quotation for the year was 5.52 cents, compared with 6.83 cents in 1929, a decrease of 19 per cent and 39 per cent under the record 1925 price. The New York market averaged 0.14 cent per pound over the St. Louis market in 1930, as compared with 0.17 cent in both 1929 and 1928.

The average price, including domestic and foreign sales, received by lead producers in the United States in 1930, according to reports of producers to the Bureau of Mines, was 5.0 cents a pound; in 1929 it was 6.3 cents.

The London quotation followed the same general trend as the New York quotation. The average for January was 4.68 cents per pound and for December 3.31 cents. The average for the year was 3.92 cents, a decrease of 22 per cent from 5.04 cents in 1929 as compared with a decrease of 19 per cent in the New York quotation. The 1930 London average was 1.12 cents below that for 1929, whereas the New York average dropped 1.31 cents. The London price was 1.60 cents under the New York price in 1930, as compared with 1.79 cents in 1929. In December, 1930, the London price reached the lowest level since 1911.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA[1]

(MINE REPORT)

By V. C. Heikes[2]

CONTENTS

	Page
Summary	515
Mining industry	520
Ore classification	522
Metallurgic industry	525
Review by counties and districts	530
Churchill County	530
Clark County	530
Elko County	532
Esmeralda County	534
Eureka County	536
Humboldt County	537
Review by counties and districts—Contd.	
Lander County	537
Lincoln County	539
Lyon County	541
Mineral County	542
Nye County	544
Ormsby County	548
Pershing County	548
Storey County	549
Washoe County	550
White Pine County	551

SUMMARY

The total value of the mine production of gold, silver, copper, lead, and zinc from Nevada mines in 1930 was $21,455,517, a decrease of $11,574,720 compared with 1929, and the number of producers reporting (280) was 58 less. The quantity and value of gold, silver, and copper decreased in 1930; the lead output was exceeded only by that in 1916, 1917, 1918, and 1925, and the zinc output was exceeded only by that in 1916. The gold output decreased from 163,711.22 to 149,064.47 ounces, the silver output from 4,923,526 to 4,219,832 ounces, and the copper output from 140,138,809 to 109,203,512 pounds. The lead output increased from 19,692,568 to 23,058,381 pounds and the zinc output from 16,920,083 to 29,168,117 pounds. The total value of the metals decreased from $33,030,237 to $21,455,517.

Nevada, often spoken of as the "Silver State," was so called when the Comstock lode was almost entirely responsible for raising the output of the United States from an insignificant amount to second place in world production. Compared with the other States, Nevada was first in output of silver between 1861 and 1878 and again between 1910 and 1915. Colorado and then Montana were leaders at different periods from 1880, followed in 1920 by Utah which has since been the leading silver State. White Pine County led in value of metals recorded in 1930 and yielded over 69 per cent of the total value of the metals produced in the State, due to the large output of copper in the county. Three other counties each produced metals worth more than $1,000,000—Lincoln County, with the largest output of lead and zinc; Nye County, with its principal values in gold and silver; and Esmeralda County, in fourth place, with its chief values also in gold and silver.

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[1] Work on manuscript completed December, 1931.

[2] Helen M. Gaylord, assisted by B. N. Lowry, both of the Bureau of Mines, prepared the statistics for this report.

The total value of the mine production of gold, silver, copper, lead, and zinc in Nevada for 1904 to 1930, inclusive, as recorded in Mineral Resources, was $739,318,780. Details of production are as follows: Ore, old tailings, etc., 106,728,581 short tons; gold, $212,292,913; silver, 250,216,682 fine ounces ($169,212,646); copper, 1,847,787,078 pounds ($309,621,243); lead, 397,460,827 pounds ($25,096,666); and zinc, 285,141,192 pounds ($23,095,312).

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	370	61	1,096,138	160,254.62	$3,312,757	7,083,782	$7,083,782
1922	345	42	1,565,276	159,510.95	3,297,384	8,619,587	8,619,587
1923	354	35	4,354,937	204,292.89	4,223,109	10,614,564	8,703,942
1924	348	36	4,699,333	217,962.56	4,505,686	9,411,379	6,305,624
1925	399	25	4,927,139	187,104.72	3,867,798	7,096,618	4,925,053
1926	377	28	5,884,568	175,381.68	3,625,461	6,518,983	4,067,845
1927	379	30	5,531,152	150,346.16	3,107,931	5,397,179	3,060,200
1928	330	29	7,057,433	175,157.79	3,620,833	5,481,574	3,206,721
1929	323	15	7,355,500	163,711.22	3,384,211	4,923,526	2,624,239
1930	247	33	4,757,178	149,064.47	3,081,436	4,219,832	1,624,635

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	10,961,491	$1,414,032	7,188,768	$323,495	69,397	$3,470	$12,137,536
1922	23,133,091	3,122,967	9,389,182	516,405	2,618,710	149,266	15,705,609
1923	67,204,282	9,879,029	18,156,337	1,270,944	14,166,550	963,325	25,040,349
1924	73,805,323	9,668,497	20,060,041	1,604,803	11,002,910	715,189	22,799,799
1925	79,300,224	11,260,632	24,476,452	2,129,451	14,821,293	1,126,418	23,309,352
1926	101,827,937	14,255,911	22,367,965	1,789,437	10,817,833	811,337	24,549,991
1927	120,259,276	15,753,965	15,784,818	994,444	6,344,523	406,049	23,322,589
1928	158,876,883	22,878,271	15,747,444	913,352	6,796,713	414,599	31,033,776
1929	140,138,809	24,664,430	19,692,568	1,240,632	16,920,083	1,116,725	33,030,237
1930	109,203,512	14,196,457	23,058,381	1,152,919	29,168,117	1,400,070	21,455,517

Gold and silver produced at placer mines in Nevada, 1921–1930

Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1921	17, 566. 99	$363, 142	7, 956	$7, 956
1922	11, 602. 36	239, 842	4, 710	4, 710
1923	3, 941. 83	81, 485	1, 783	1, 462
1924	1, 323. 97	27, 369	546	366
1925	2, 536. 54	52, 435	1, 285	892
1926	2, 866. 17	59, 249	1, 494	932
1927	1, 809. 22	37, 400	740	419
1928	1, 851. 12	38, 266	839	491
1929	2, 117. 00	43, 762	1, 025	546
1930	1, 859. 44	38, 438	847	326

GOLD

The mine production of gold in Nevada decreased from $3,384,211 in 1929 to $3,081,436 in 1930. In 1930, as in 1929 and 1928, the Nevada Consolidated Copper Co. was by far the largest producer of gold in Nevada. Ore, etc., was treated by amalgamation in 14 counties and ore, old tailings, etc., by cyanidation in 9 counties in 1930. By these two methods $1,727,093 in gold was recovered from 242,365 tons of ore and 278,230 tons of old tailings, etc. Most of the placer gold in 1930 was obtained by hydraulicking and drifting in the Round Mountain and Manhattan districts, Nye County, and by drifting and sluicing in the Battle Mountain district, Lander County. Amalgamation and cyanidation mills yielded 56 per cent of the total gold, concentrates 35 per cent (practically all in flotation concentrates), and crude smelting ore nearly 8 per cent.

Six properties supplied nearly 74 per cent of the total gold from Nevada in 1930, each producing more than 10,000 ounces. The Nevada Consolidated property at Ely was first, followed by the Elkoro at Jarbidge, the Tonopah Extension at Tonopah, the Goldfield Consolidated tailings dump (Bradshaw (Inc.)) at Goldfield, the Consolidated Coppermines at Kimberly, and the Seven Troughs Gold Mines near Lovelock. Five other properties produced between 2,000 and 5,000 ounces of gold each.

SILVER

In 1930 the mine production of silver in Nevada was 4,219,832 fine ounces, a decrease of 703,694 ounces from 1929. In Esmeralda County 1,430,188 ounces of silver were contained in bullion recovered at amalgamation and cyanidation mills; most of this silver (1,429,885 ounces) was recovered by cyanidation. Concentrates recovered from ores produced in Nevada yielded 1,458,320 ounces of silver; 1,444,736 ounces were contained in flotation concentrates. Lead concentrates yielded 948,794 ounces of silver, an average recovery of 61.28 ounces a ton, compared with 1,117,663 ounces, an average of 89.72 ounces a ton, in 1929.

Nine properties, each producing more than 100,000 ounces, yielded 91 per cent of the total silver from Nevada in 1930. These properties, in order of output, were the Tonopah Extension at Tonopah, the Treadwell Yukon at Tybo, the Combined Metals and the Bristol

Silver, both near Pioche, the Tonopah Belmont and the Tonopah Mining, both at Tonopah, the Elkoro at Jarbidge, the Piermont at Aurum, and the Nevada Consolidated at Ely.

COPPER

In 1930 the mine production of copper in Nevada was 109,203,512 pounds, a decrease of 22 per cent from 1929. The total value decreased $10,467,973, or over 42 per cent, compared with 1929. Concentrates yielded nearly 85 per cent of the total copper, and crude ore shipped to smelters yielded 15 per cent. Flotation concentrates yielded 92,508,865 pounds and table concentrates 3,541 pounds. The Nevada Consolidated Copper Co., operating its mine, mill, and smelter at Ely and McGill, was the largest producer of copper in the State. This property with three others—the Consolidated Coppermines at Kimberly, the Bristol Silver near Pioche, and the Copper Canyon property near Battle Mountain—yielded more than 99 per cent of the total copper from Nevada in 1930.

LEAD

The mine production of lead in Nevada in 1930 was 23,058,381 pounds, an increase of 3,365,813 pounds over 1929. The 1930 output has been exceeded only by that of four years—1916, 1917, 1918, and 1925. Concentrates recovered from the milling of ore yielded 17,067,944 pounds of lead, of which 17,052,813 pounds were contained in flotation and 15,131 pounds in table concentrates. The total crude ore of shipping grade yielded 5,990,437 pounds of lead, compared with 8,417,222 pounds in 1929. More than 77 per cent of the lead in 1930 came from lead-zinc ore, and nearly 10 per cent came from lead ore.

Seven mines yielded over 95 per cent of the total lead from Nevada in 1930. The Combined Metals property in Lincoln County was the largest producer, followed by the Treadwell Yukon in Nye County, Bristol Silver in Lincoln County, Panther Mines in Elko County, Yellow Pine in Clark County, Richmond-Eureka in Eureka County, and the Nevada Lead & Zinc in Elko County.

ZINC

In 1930 the mine production of zinc in Nevada was 29,168,117 pounds, an increase of 12,248,034 pounds over 1929. The 1930 output has been exceeded only by that in 1916, which was 32,443,189 pounds. The Pioche district in Lincoln County produced 76 per cent of the total zinc output of the State, followed by the Tybo district in Nye County and the Yellow Pine district in Clark County. The Combined Metals near Pioche in Lincoln County, the Treadwell Yukon mine in Nye County, and four properties in the Yellow Pine district in Clark County yielded all the zinc produced in the State.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1930, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Churchill	39.09	$808	----------	----------	$808	3,327	$1,281
Clark	1,368.77	28,295	----------	----------	28,295	6,565	2,527
Elko	22,711.38	469,486	----------	----------	469,486	290,614	111,886
Esmeralda	31,564.64	652,499	----------	----------	652,499	1,433,961	552,075
Eureka	733.46	15,162	72.85	$1,506	16,668	61,465	23,664
Humboldt	132.55	2,740	13.30	275	3,015	199	76
Lander	1,531.07	31,650	204.29	4,223	35,873	31,426	12,099
Lincoln	1,822.72	37,679	----------	----------	37,679	843,574	324,776
Lyon	1,039.92	21,497	15.14	313	21,810	11,651	4,486
Mineral	1,141.70	23,601	----------	----------	23,601	5,307	2,043
Nye	20,166.23	416,873	1,425.66	29,471	446,344	1,139,782	438,816
Ormsby	4.45	92	----------	----------	92	2	1
Pershing	10,836.63	224,013	71.84	1,485	225,498	24,514	9,438
Storey	2,435.79	50,352	----------	----------	50,352	25,296	9,739
Washoe	353.18	7,301	----------	----------	7,301	651	251
White Pine	51,323.45	1,060,950	56.36	1,165	1,062,115	341,498	131,477
	147,205.03	3,042,998	1,859.44	38,438	3,081,436	4,219,832	1,624,635
Total, 1929	161,594.22	3,340,449	2,117.00	43,762	3,384,211	4,923,526	2,624,239

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill	55	$7	30,348	$1,517	----------	----------	$3,613
Clark	18,346	2,385	966,686	48,334	2,474,323	$118,768	200,309
Elko	157,323	20,452	1,298,985	64,949	----------	----------	666,773
Esmeralda	19,287	2,507	4,570	229	----------	----------	1,207,310
Eureka	10,784	1,402	402,977	20,149	----------	----------	61,883
Humboldt	5,855	761	1,900	95	----------	----------	3,947
Lander	1,316,572	171,154	33,740	1,687	----------	----------	220,813
Lincoln	1,995,571	259,424	12,738,686	636,934	22,171,629	1,064,238	2,323,051
Lyon	233,766	30,390	886	44	----------	----------	56,730
Mineral	6,538	850	4,100	205	----------	----------	26,699
Nye	2,502	325	7,246,112	362,306	4,522,165	217,064	1,464,855
Ormsby	----------	----------	----------	----------	----------	----------	93
Pershing	33,357	4,337	36,032	1,802	----------	----------	241,075
Storey	----------	----------	----------	----------	----------	----------	60,091
Washoe	3,430	446	----------	----------	----------	----------	7,998
White Pine	105,400,126	13,702,017	293,359	14,668	----------	----------	14,910,277
	109,203,512	14,196,457	23,058,381	1,152,919	29,168,117	1,400,070	21,455,517
Total, 1929	140,138,809	24,664,430	19,692,568	1,240,632	16,920,083	1,116,725	33,030,237

Ore, old tailings, etc., sold or treated, lode mines producing, and average value of ore, etc., in gold and silver in Nevada, 1929 and 1930, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Churchill	976	1,047	3	3	$2.01	$2.00
Clark	7,274	10,458	23	16	5.99	2.95
Douglas	60	----------	3	----------	8.35	----------
Elko	78,016	63,355	37	29	11.46	9.18
Esmeralda	351,930	380,236	27	27	2.48	3.17
Eureka	49,311	3,521	9	5	6.62	11.45
Humboldt	644	294	12	4	74.92	10.51
Lander	27,159	9,752	25	24	5.47	4.92
Lincoln	121,010	119,907	8	5	4.07	3.02
Lyon	182,311	4,714	20	13	.36	5.58
Mineral	1,931	1,584	33	15	31.77	16.19
Nye	131,074	128,385	47	41	10.51	6.89
Ormsby	1,219	2	2	2	.16	46.50
Pershing	4,799	15,778	17	13	8.44	14.89
Storey	11,244	6,198	13	14	11.31	9.70
Washoe	322	322	14	11	10.32	23.45
White Pine	6,386,220	4,011,625	30	25	.23	.30
	7,355,500	4,757,178	323	247	.81	.99

Gold and silver produced at placer mines in Nevada in 1930, by counties

County	Mines		Gold	Silver (fine ounces)	Total value
	Drift	Hydraulic and sluicing			
Eureka		1	$1,506	5	$1,508
Humboldt		2	275	4	277
Lander	9		4,223	33	4,236
Lyon		2	313	5	315
Nye	10	1	29,471	780	29,771
Pershing		3	1,485	9	1,488
White Pine	5		1,165	11	1,169
	24	9	38,438	847	38,764
Total, 1929	6	9	43,762	1,025	44,308

MINING INDUSTRY

The mining industry of Nevada in 1930 was directly affected by the low value of metals, which was the cause of material curtailment of operations. Copper started the year selling at 18 cents a pound. On account of the decrease in consumption during the year there were reductions in the selling price until October when it was 9½ cents, the lowest level in 35 years. Conditions at the end of the year were still unsettled by the comparatively large stocks of copper on hand, with the price around 10½ cents. Silver started at 45 cents an ounce in January and slumped to 32.6 cents in December. Lead was quoted at 6¼ and 5.1 cents a pound for January and December, respectively, and zinc at 5.23 and 4.1 cents. These low metal prices and the curtailment in mining reduced the total value of metals $11,574,720, of which $999,604 was in silver and $10,467,973 in copper. Part of the decrease was offset by the record output of lead and zinc from mines near Pioche in Lincoln County. Tonopah mining companies and their lessees were the greatest sufferers from the decline in the price of silver, as their product was classed as silver ore having a small gold content. The Cortez mine near Beowawe and the Betty O'Neal near Battle Mountain, both silver mines, were closed in January, 1930. Gold mining and production increased at Goldfield, Seven Troughs, Round Mountain, Manhattan, and New Pass. The State's total of siliceous ores, old tailings, etc., increased from 537,664 tons in 1929 to 543,049 tons in 1930, with the output of gold from this particular class of material increasing from 90,655.65 ounces ($1,874,018) in 1929 to 93,031.52 ounces ($1,923,132) in 1930. The bullion recovered from 34,565 tons of ore, etc., treated in amalgamation mills in 1930 contained 9,601.13 ounces of gold ($198,473) and 8,037 ounces of silver. At cyanidation plants 207,801 tons of ore and 278,229 tons of old tailings, etc., were treated in 1930, compared with 205,280 tons of ore and 282,820 tons of old tailings in 1929. The recovery of gold by cyanidation in 1930 amounted to 73,946.97 ounces ($1,528,620) and that of silver to 2,232,481 ounces. Gold from placer mining declined from 2,117.00 ounces ($43,762) in 1929 to 1,859.44 ounces ($38,438) in 1930.

The world production of gold was summarized in a recent economic report[3] of the United States Bureau of Mines. The Bureau of Mines also collaborated with the United States Geological Survey in a detailed summary[4] relating to the gold resources and reserves in the United States. Gold was one of the main topics for discussion at the International Geologic Congress at Pretoria, South Africa, in 1929. As to the possible gold resources of Nevada, H. G. Ferguson[5] makes the following statements and gives bibliographical references:

> *Deposits.*—Gold has been produced in Nevada from deposits of several different types. Deep-seated quartz veins in the western part of the State have yielded chiefly silver from supergene ores; but a few, such as those in the Silver Peak region, have been large gold producers. The output from deposits of this type is now only a fraction of its former size. Deep-seated silver-lead deposits, chiefly in the eastern part of the State, have only a low tenor in gold, though in the aggregate the output is considerable. The only continuously productive copper district is that of Ely; other copper districts are productive only during periods of high prices. Deposits of Tertiary age have in the past yielded the largest part of the total gold output, either in connection with a large silver output, as at Comstock and Tonopah, or in lodes yielding essentially only gold, as at Goldfield. Placer production has been small.
>
> *Future production.*—The State has been thoroughly prospected, and new discoveries of lodes with prominent outcrops are hardly to be expected. Many of the Tertiary gold lodes, however, have inconspicuous outcrops, and there may be new discoveries of deposits of this type. Such deposits are, however, characteristically shallow, and only a very small proportion of those heretofore discovered have proved to be valuable. The larger producing precious-metal districts are approaching exhaustion; but an increase in the price of silver, if extending over several years, would result in an increased gold production from such districts as Tonopah and Comstock. The deposits of the deep-seated quartz vein type are not expected to give much future production, even under very favorable conditions. The replacement deposits mined for lead and for lead and zinc have large possible reserves, but their gold content is low. A large future production may be expected from the copper ores of Ely, and in periods of high copper prices, gold will be won from the copper ores of other districts.

Estimated gold production of Nevada, 1928–1950, in ounces

	Minimum	Maximum
Deep-seated precious-metal veins	15, 000	150, 000
Base-metal deposits, except Ely	50, 000	200, 000
Ely copper deposits	800, 000	1, 200, 000
Tertiary gold deposits	135, 000	350, 000
Tertiary silver and silver-gold deposits	350, 000	800, 000
	1, 350, 000	2, 700, 000

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General.—Lincoln, F. C., Mining districts and mineral resources of Nevada, Reno, Nevada Newsletter Publishing Co., 1923.

Ferguson, H. G., The mining districts of Nevada: Econ. Geology, vol. 24, pp. 115–148, 1929.

These papers contain references to publications that describe individual districts.

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[3] Ridgway, R. H., Summarized Data of Gold Production: Econ. Paper 6, Bureau of Mines, 1929, 63 pp.

[4] Gold Reserves of United States: Reprint from "The Gold Resources of the World," 15th Internat. Geol. Cong., So. Africa, 1929.

[5] See footnote 4.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Nevada, 1921–1930, with content in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
DRY AND SILICEOUS ORE						
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	667,760	143,294.94	6,649,514	229,989	1,574,507	
1922	871,883	140,706.36	7,809,877	146,098	922,439	
1923	1,371,970	167,193.70	9,084,056	776,303	4,632,914	
1924	1,060,479	181,627.55	8,062,859	305,183	2,438,791	
1925	844,948	140,878.23	5,261,402	61,858	1,016,134	
1926	806,518	120,616.10	4,509,178	51,778	867,420	
1927	617,822	93,701.70	3,419,940	41,023	179,711	
1928	641,004	100,399.36	2,977,433	33,112	44,448	
1929	557,661	90,655.65	2,828,537	47,539	178,119	
1930	543,049	93,031.52	2,478,009	33,073	19,387	
COPPER ORE						
1921	401,153	4,747.21	19,323	10,318,851	21	
1922	629,408	4,400.63	17,127	[1] 22,640,042	124	
1923	2,813,908	29,551.15	84,568	66,089,635	2,097	
1924	3,505,201	32,314.93	109,614	[1] 73,325,336		
1925	3,923,158	35,515.84	122,477	[1] 78,795,059		
1926	4,888,681	36,408.95	142,316	[1] 109,870,898	1,417	
1927	4,884,052	46,883.96	183,525	[1] 118,667,463	18	
1928	6,244,047	68,750.96	258,519	156,746,489	1,069	
1929	6,572,404	65,287.67	275,254	137,662,757	9,982	
1930	4,015,426	50,083.92	270,512	[2] 107,907,111	377,130	
LEAD ORE						
1921	25,797	4,614.98	496,826	384,739	5,415,434	
1922	39,462	2,979.85	698,560	331,268	6,266,047	
1923	84,761	2,571.61	1,238,842	300,625	8,372,022	
1924	81,202	1,995.82	1,695,429	154,363	10,314,895	
1925	94,709	6,882.73	1,361,733	351,494	16,131,783	
1926	111,265	8,738.16	1,395,285	252,687	14,224,647	
1927	75,924	6,214.20	1,405,418	181,972	10,160,264	
1928	101,416	3,143.86	1,593,463	183,616	7,764,803	
1929	74,839	3,212.86	671,478	84,771	4,274,324	
1930	10,413	1,037.94	148,033	36,003	2,213,843	
COPPER-LEAD ORE						
1921	1,689	30.50	20,163	27,912	154,288	
1922	102	1.90	2,153	11,283	59,869	
1923	330	708.16	13,089	21,769	60,578	
1924	3	.05	1,786	489	893	
1925	125	4.87	3,229	11,426	43,851	
1926	10,151	203.51	147,470	594,800	1,283,217	
1927	25,304	416.89	280,713	1,323,304	2,764,002	
1928	40,329	850.85	185,946	1,835,129	5,120,612	
1929	56,644	727.23	491,173	2,522,866	4,931,359	
1930	30,171	383.51	278,792	1,225,225	2,560,840	
ZINC ORE AND LEAD-ZINC ORE						
1921	139				44,718	69,397
1922	24,421	19.85	87,150	4,560	2,159,743	2,618,710
1923	63,965	322.66	192,226	15,860	5,108,146	14,166,550
1924	46,348	700.23	206,143	21,912	7,302,[illegible]	11,002,910
1925	64,139	1,288.49	343,442	90,407	7,284,881	14,824,293
1926	67,953	749.79	323,240	57,774	5,909,258	10,817,[illegible]
1927	29,047	314.39	106,843	45,524	2,880,293	6,344,123
1928	30,637	477.61	163,374	78,037	2,816,581	6,796,713
1929	113,949	1,710.81	676,057	16,876	10,298,784	16,920,083
1930	158,119	2,668.14	1,063,629	2,100	17,887,171	29,168,117

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[1] Includes copper saved from precipitates recovered from mine water.

[2] Includes 8,847 pounds of copper recovered from "cyanide" precipitates.

Ore, old tailings, etc., sold or treated in Nevada in 1930, with content in terms of recovered metals

Source	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	[1] 414,023	72,690.07	334,890	31,712	8,472	
Dry gold and silver ore	1,523	283.78	17,094	418	4,422	
Dry silver ore	127,503	20,057.67	2,126,025	943	6,493	
Copper ore	4,015,426	50,083.92	270,512	[2] 107,907,111	377,130	
Lead ore	10,413	1,037.94	148,033	36,003	2,213,843	
Zinc ore	158				8,720	91,008
Copper-lead ore	30,171	383.51	258,792	1,225,225	2,560,850	
Lead-zinc ore	157,961	2,668.14	1,063,639	2,100	17,878,451	29,077,109
Total, lode mines	4,757,178	147,205.03	4,218,985	109,203,512	23,058,381	29,168,117
Total, placers		1,859.44	847			
	4,757,178	149,064.47	4,219,832	109,203,512	23,058,381	29,168,117
Total, 1929	7,355,500	163,711.22	4,923,526	140,138,809	19,692,568	16,920,083

[1] Includes 278,228 tons of old tailings and 1 ton of old mill cleanings cyanided, 1 ton of old mill cleanings from which amalgam was recovered, and 1 ton of old mill cleanings sold to a smelter.

[2] Includes 8,847 pounds of copper recovered from "cyanide" precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Nevada in 1930, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	414,023	$1,502,637	$128,933	$4,123	$424		$1,636,117
Dry gold and silver ore	1,523	5,866	6,581	54	221		12,722
Dry silver ore	127,503	414,629	818,519	123	325		1,233,596
Copper ore	4,015,426	1,035,327	104,147	[1] 14,027,925	18,856		15,186,255
Lead ore	10,413	21,456	56,993	4,680	110,692		193,821
Zinc ore	158				436	$4,369	4,805
Copper-lead ore	30,171	7,928	99,635	159,279	128,042		394,884
Lead-zinc	157,961	55,155	409,501	273	893,923	1,395,701	2,754,553
	4,757,178	3,042,998	1,624,309	14,196,457	1,152,919	1,400,070	21,416,753
Total, 1929	7,355,500	3,340,449	2,623,693	24,664,430	1,240,632	1,116,725	32,985,929

[1] Includes value of 8,847 pounds of copper recovered from "cyanide" precipitates.

Ore, old tailings, etc., sold or treated in Nevada in 1930, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	3,610	1,112.35	4,181	110	393	
Elko	58,716	22,659.95	229,579			
Esmeralda	[1] 280,955	17,236.19	14,924	92	3,393	
Eureka	2	2.00	6	46		
Humboldt	256	131.58	43			
Lander	[2] 1,380	1,290.67	4,414	6,438	1,000	
Lyon	2,575	873.60	646			
Mineral	1,529	1,128.43	1,658	107	353	
Nye	[3] 38,217	13,207.72	21,395		333	
Ormsby	[4] 2	4.47	2			
Pershing	15,563	10,834.98	23,253			
Storey	[5] 6,198	2,435.78	25,296			
Washoe	301	352.19	152			
White Pine	[6] 4,719	1,420.16	9,341	24,919	3,000	
	414,023	72,690.07	334,890	31,712	8,472	
Total, 1929	384,381	65,742.36	289,345	12,056	5,816	

[1] Includes 277,100 tons of old tailings cyanided.

[2] Includes 40 tons of old tailings cyanided.

[3] Includes 500 tons of old tailings cyanided.

[4] Includes 1 ton of old mill cleanings from which amalgam was recovered and 1 ton of old mill cleanings sold to a smelter.

[5] Includes 1 ton of old mill cleanings cyanided.

[6] Includes 588 tons of old tailings cyanided.

Ore, old tailings, etc., sold or treated in Nevada in 1930, by counties, in terms of recovered metals—Continued

DRY GOLD AND SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	1,000	35.96	2,077			
Esmeralda	458	140.00	9,101			
Eureka	41	17.32	2,439	70	2,133	
Nye	12	23.50	1,352	102	389	
White Pine	12	37.00	2,125	246	1,900	
	1,523	283.78	17,094	418	4,422	
Total, 1929	3,953	1,725.61	63,763	12,655	17,916	

DRY SILVER ORE

Esmeralda	98,689	14,126.30	1,407,373			
Lander	15	9.00	1,708			
Lincoln	21	2.00	945	96		
Lyon	774	126.32	10,241		886	
Mineral	30	12.54	3,630	225	1,673	
Nye	15,997	5,563.32	533,790	300	934	
White Pine	11,977	218.19	168,338	322	3,000	
	127,503	20,057.67	2,126,025	943	6,493	
Total, 1929	149,330	23,187.68	2,475,429	22,828	154,387	

COPPER ORE

Clark	38	1.00	45	17,133		
Elko	1,094	43.52	2,614	137,048	2,000	
Esmeralda	110	35.41	1,038	[7] 19,195		
Humboldt	35	1.00	85	5,855		
Lander	6,896	178.59	5,335	1,308,784		
Lincoln	11,095	139.34	102,036	772,012	375,130	
Lyon	1,365	40.00	759	233,766		
Mineral	20	.60		6,206		
Pershing	143		175	33,208		
Washoe	21	.98	499	3,430		
White Pine	3,994,609	49,643.48	157,926	105,370,474		
	4,015,426	50,083.92	270,512	[7] 107,907,111	377,130	
Total, 1929	6,572,404	65,287.67	255,254	137,666,757	9,982	

LEAD ORE

Churchill	47	3.13	1,250	55	30,348	
Clark	1,384	255.41	2,339	1,163	58,643	
Elko	3,545	7.92	58,421	20,275	1,296,985	
Esmeralda	24	26.71	1,525		1,177	
Eureka	3,478	684.13	59,015	10,668	400,844	
Humboldt	3		67		1,900	
Lander	1,461	52.80	19,936	1,350	32,740	
Lincoln	102	1.53	1,527	524	76,323	
Mineral	5	.10	19		2,074	
Pershing	72	1.65	1,077	149	36,032	
White Pine	292	4.56	2,857	1,879	276,777	
	10,413	1,037.94	148,033	36,063	2,213,843	
Total, 1929	74,839	3,212.86	671,478	84,771	4,274,324	

ZINC ORE

Clark	158				8,720	91,008
	158				8,720	91,008
Total, 1929	177		378	70	12,536	118,613

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[7] Includes 8,847 pounds of copper recovered from "cyanide" precipitates.

Ore, old tailings, etc., sold or treated in Nevada in 1930, by counties, in terms of recovered metals—Continued

COPPER-LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Lincoln	30,155	383.41	257,892	1,222,939	2,552,168	
White Pine	16	.10	900	2,286	8,682	
	30,171	383.51	258,792	1,225,225	2,560,850	
Total, 1929	56,644	727.23	491,175	2,322,866	4,931,359	

LEAD-ZINC ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Clark	5,268				898,930	2,383,315
Lincoln	78,534	1,296.46	481,174		9,735,065	22,171,629
Nye	74,159	1,371.68	582,465	2,100	7,244,456	4,522,165
	157,961	2,668.14	1,063,639	2,100	17,878,451	29,077,109
Total, 1929	113,772	1,710.81	675,679	16,806	10,286,248	16,801,470

Zinc products from Nevada mines sold to mills and smelters in 1930

Classification	County	Ore (dry weight)	Gross zinc	Average assay of ore	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Oxidized zinc ore	Clark	158	113,760	36.00	91,008
Oxidized and sulphide lead-zinc ore [1]	Clark, Lincoln, and Nye	157,961	33,515,022	10.61	29,077,109
		158,119	33,628,782	10.63	29,168,117
Total, 1929		113,949	19,502,772	8.56	16,920,083

[1] To avoid disclosing individual production, tonnage of zinc concentrates not shown.

METALLURGIC INDUSTRY

Mine operators in Nevada in 1930 found the usual outlet for the treatment of their ore, namely, the McGill plant of the Nevada Consolidated Copper Co.; the flotation plant of the Combined Metals Reduction Co. near Stockton, Utah; the smelters of the American Smelting & Refining Co. in California and Utah; and the smelters of the International Smelting Co. and the United States Smelting, Refining & Mining Co. in Utah. Flotation was the principal process in the reduction work at McGill in White Pine County, at Tybo in Nye County, and at the Combined Metals Reduction Co. plant in Utah, all of which were operated continuously throughout the year. At McGill the Nevada Consolidated Copper Co. milled both company and custom ore, smelted crude ore and concentrates, and shipped blister copper both direct and to points on San Francisco Bay for water transportation to the refinery at Baltimore, Md. At Tybo the Treadwell Yukon Co. (Ltd.) treated only company ore and shipped lead concentrates to the Selby smelter and zinc concentrates to the Sullivan electrolytic zinc reduction plant at Silver King, Idaho. The Combined Metals Reduction Co. treated company ore from the Pioche mines, as well as custom ore, and shipped zinc concentrates to Montana for electrolytic refining and lead concentrates to Tooele, Utah. The custom mill of the Tonopah Mining Co. at Millers treated both company and custom ore by cyanidation, and the Trimble and Donovan mills at Silver City also received small lots of ore for amalgamation and cyanidation. The last operations at the Betty O'Neal and Cortez silver camps were in January, 1930, and at the Piermont property in White Pine County in September; these three properties are equipped with flotation mills. The adoption of flotation following amalgamation was successful on gold and silver ores at two mills in the Silver Peak district, Esmeralda County; and experiments were carried on with flotation units installed in mills in the Talapoosa, Cherry Creek, Como, Hilltop, and Seven Troughs districts. The small flotation plant of the Rip Van Winkle mine in the Merrimac district, Elko County, was not finished, but it was reported nearly complete in November.

Fifty-seven milling plants of various kinds treated ore, old tailings, etc., in Nevada in 1930. Of these, 28 used the amalgamation process; 5 amalgamation and concentration; 7 concentration (5 flotation and 2 table concentration); 12 cyanidation; 1 amalgamation, concentration, and cyanidation; 1 amalgamation and cyanidation; and 3 amalgamation and flotation.

About 1,106 pounds of quicksilver were purchased for use at amalgamation plants, and 758,412 pounds of cyanide were used in cyanidation mills. Of the cyanide reagent used 509 pounds were reported as cyanamid.

Large mills in Nevada active in 1930

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Class of ore treated	Product
			Short tons per day		
Nevada Consolidated Copper Co. (partly custom mill).	McGill	Flotation	18,000	Copper	Copper concentrates.
Bradshaw (Inc.)	Goldfield	Cyanidation	1,000	Tailings	Gold and silver precipitates.
Tonopah Extension Mines (Inc.).	Tonopah	do	500	Siliceous gold and silver ore.	Gold and silver bullion.
Tonopah Mining Co. of Nevada (custom mill).	Millers	do	400	do	Do.
Treadwell Yukon Co. (Ltd.).	Tybo	Flotation	350	Lead-zinc ore	Silver-lead concentrates and zinc concentrates.

Mine production of metals in Nevada in 1930, by methods of recovery

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	[1] 34,365	9,605.13	8,047			
Ore, old tailings, etc., cyanided	486,030	73,946.77	2,232,381	8,847		
Ore smelted	[2] 221,794	11,709.02	520,147	16,682,229	5,960,457	2,474,323
Concentrates smelted:						
Flotation	236,770	[illegible]	1,444,736	92,508,895	17,082,813	26,693,794
Table	229	1,888.44	13,584	3,541	15,111	
Total, lode mines		147,205.01	4,218,985	109,203,512	23,058,381	29,168,117
Total, placers		1,859.46	847			
		149,064.47	4,219,832	109,203,512	23,058,381	29,168,117
Total, 1929		163,711.22	4,923,729	140,138,809	19,692,568	16,920,083

[1] Includes 1 ton of old mill cleanings from which amalgam was recovered.
[2] Includes 1 ton of old mill cleanings.

Mine production of metals from gold and silver mills in Nevada in 1930, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Churchill	1,000		35.96	2,077		
Clark	3,603		712.51	331	313.83	3,203
Elko	58,669		528.22	410	21,963.12	225,126
Esmeralda	102,613	[1] 277,100	1,151.06	303	28,806.18	1,429,885
Humboldt	256		131.58	43		
Lander	677	40	241.48	286	30.29	45
Lyon	2,575		685.90	465		
Mineral	1,509		253.32	174	584.16	1,031
Nye	49,820	500	3,909.36	2,178	10,889.83	532,864
Ormsby		1	2.10			
Pershing	15,538		96.88	57	10,593.87	22,506
Storey	5,604	1	1,253.32	1,505	765.50	16,384
Washoe	301		352.19	152		
White Pine	200	588	247.25	56	.19	1,437
	242,365	[1] 278,230	9,601.13	8,037	73,946.97	2,232,481
Total, 1929	229,923	[2] 282,820	6,181.39	13,259	73,657.12	2,432,773

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Clark	8	77.01	635	77	393
Esmeralda	69	1,068.80	461		2,903
Lyon	5	187.70	181		
Mineral	18	219.89	239		317
Storey	6	61.67	169		
	106	1,615.07	1,685	77	3,613
Total, 1929	17	212.38	604		1,073

[1] Yielded also 8,847 pounds of copper contained in "cyanide" precipitates.
[2] Yielded also 8,949 pounds of copper contained in "cyanide" precipitates.

Gross metal content of concentrates from concentrating mills in Nevada in 1930, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	319	560.17	177,739	3,903	7,449	
Copper	192,244	47,099.78	149,948	95,363,714		
Lead	15,482	2,250.27	948,794	8,436	16,993,896	
Zinc	28,857	732.62	180,154		1,065,063	30,535,879
	236,902	50,642.84	1,456,635	95,376,053	18,066,408	30,535,879
Total, 1929	414,329	65,813.60	1,676,189	136,708,477	11,890,478	18,152,339

Nevada ore concentrated in 1930, by methods of concentration

Method of concentration	Ore concentrated	Concentrates and metal content		
		Concentrates produced[1]	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	4,013,829	236,771	50,275.76	1,444,684
Table	1,160	131	367.08	11,951
	4,014,989	236,902	50,642.84	1,456,635

Method of concentration	Concentrates and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	95,372,482	92,508,865	18,054,112	17,052,651	30,535,879	26,693,794
Table	3,571	3,464	12,296	11,680		
	95,376,053	92,512,329	18,066,408	17,064,331	30,535,879	26,693,794

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[1] Figures do not include 106 tons from ore first treated by amalgamation containing 1,615.07 ounces of gold, 1,685 ounces of silver, 118 pounds of copper (77 pounds recovered), and 3,804 pounds of lead (3,613 pounds recovered).

Mine production of metals from concentrating mills in Nevada in 1930, in terms of recovered metals

BY COUNTIES

	Ore treated	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	1,339	48	251.19	1,840	776	23,867	
Elko	100	23	24.00	584		9,130	
Esmeralda	28	2	27.41	492		999	
Eureka	1,621	148	37.55	44,417	1,722	37,252	
Lander	1,569	137	190.45	18,573	4,607	9,676	
Lincoln	78,534	32,920	1,296.46	481,174		9,735,065	22,171,629
Lyon	774	13	126.32	10,241		886	
Nye	74,159	11,153	1,371.68	582,465	2,100	7,244,456	4,522,165
White Pine	3,856,865	192,458	47,317.78	316,849	92,503,124	3,000	
	4,014,989	236,902	50,642.84	1,456,635	92,512,329	17,064,331	26,693,794
Total, 1929	[1] 6,609,780	414,329	65,813.60	1,676,189	128,899,176	11,228,182	15,836,658

BY CLASSES OF CONCENTRATES

Dry and siliceous	319	560.17	177,739	3,786	4,376	
Copper	192,244	47,099.78	149,948	92,502,802		
Lead	15,482	2,250.27	948,794	5,741	16,144,202	
Zinc	28,857	732.62	180,154		915,753	26,693,794
	236,902	50,642.84	1,456,635	92,512,329	17,064,331	26,693,794

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[1] Includes 2,570 tons of old tailings

Gross metal content of Nevada concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	425	2,175.24	179,424	4,021	11,253	----------
Copper	192,244	47,099.78	149,948	95,363,714	----------	----------
Lead	15,482	2,250.27	948,794	8,436	16,993,896	----------
Zinc	28,857	732.62	180,154	----------	1,065,063	30,535,879
	237,008	52,257.91	1,458,320	95,376,171	18,070,212	30,535,879
Total, 1929	414,346	66,025.98	1,676,793	136,708,477	11,891,607	18,152,339

Mine production of metals from Nevada concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	56	328.20	2,475	853	24,260	----------
Elko	23	24.00	584	----------	9,130	----------
Esmeralda	71	1,096.21	953	----------	3,902	----------
Eureka	148	37.55	44,417	1,722	37,252	----------
Lander	137	190.45	18,573	4,607	9,676	----------
Lincoln	32,920	1,296.46	481,174	----------	9,735,065	22,171,629
Lyon	18	314.02	10,422	----------	886	----------
Mineral	18	219.89	239	----------	317	----------
Nye	11,153	1,371.68	582,465	2,100	7,244,456	4,522,165
Storey	6	61.67	169	----------	----------	----------
White Pine	192,458	47,317.78	316,849	92,503,124	3,000	----------
	237,008	52,257.91	1,458,320	92,512,406	17,067,944	26,693,794
Total, 1929	414,346	66,025.98	1,676,793	128,899,176	11,229,255	15,836,658

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	425	2,175.24	179,424	3,863	7,989	----------
Copper	192,244	47,099.78	149,948	92,502,802	----------	----------
Lead	15,482	2,250.27	948,794	5,741	16,144,202	----------
Zinc	28,857	732.62	180,154	----------	915,753	26,693,794
	237,008	52,257.91	1,458,320	92,512,406	17,067,944	26,693,794

Gross metal content of Nevada crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	10,000	7,305.81	58,065	31,016	16,341	----------
Copper	169,950	2,984.14	120,564	15,871,912	754,261	----------
Lead	6,046	723.19	82,724	42,184	2,247,560	----------
Zinc	158	----------	----------	----------	12,640	113,760
Copper-lead	30,171	383.51	258,792	1,441,921	2,695,632	----------
Lead-zinc	5,268	----------	----------	----------	1,294,200	2,979,143
	221,593	11,396.65	520,145	17,387,033	7,020,634	3,092,903
Total, 1929	232,057	15,446.73	784,196	12,114,343	9,004,529	1,350,433

Mine production of metals from Nevada crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	47	3.13	1,250	55	30,348	
Clark	5,516	14.22	556	17,493	942,426	2,474,323
Elko	4,586	196.05	64,494	157,323	1,289,855	
Esmeralda	495	511.16	2,820	10,440	668	
Eureka	1,900	695.90	17,043	9,062	365,725	
Humboldt	38	1.00	152	5,855	1,900	
Lander	7,466	1,068.84	12,489	1,311,965	24,064	
Lincoln	41,373	526.28	362,400	1,995,571	3,003,621	
Lyon	1,365	40.00	759	233,766		
Mineral	75	84.30	3,863	6,538	3,783	
Nye	3,906	3,995.35	21,495	402	1,656	
Pershing	240	145.88	1,942	33,357	36,032	
Storey	593	355.29	7,238			
Washoe	21	.98	499	3,430		
White Pine	153,972	3,758.27	23,145	12,897,002	290,359	
	221,593	11,396.65	520,145	16,682,259	5,990,437	2,474,323
Total, 1929	232,057	15,446.73	784,196	11,228,682	8,417,222	1,083,425

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	10,000	7,305.81	58,065	29,210	11,398	
Copper	169,950	2,984.14	120,564	15,395,462	377,130	
Lead	6,046	723.19	82,724	32,362	2,133,409	
Zinc	158				8,720	91,008
Copper-lead	30,171	383.51	258,792	1,225,225	2,560,850	
Lead-zinc	5,268				898,930	2,383,315
	221,593	11,396.65	520,145	16,682,259	5,990,437	2,474,323

REVIEW BY COUNTIES AND DISTRICTS

CHURCHILL COUNTY

The value of the mine production of metals in Churchill County decreased from $10,894 in 1929 to $3,613 in 1930. With the exception of an increase in gold there was a decrease in the value of each of the metals produced.

Fairview district.—The property of the Chalk Mountain Silver-Lead Mines Co. produced one lot of oxidized lead ore, which was shipped to a smelter in Utah. The 50-ton concentration mill on the property was idle. Low metal prices caused the closing of the mine in July.

Sandsprings district.—The Double Ender & Dan Tucker property 30 miles east of Fallon produced approximately 1,000 tons of gold and silver ore that were treated by amalgamation in a 10-foot Lane mill.

Wonder district.—Development work was begun preparatory to shipping ore from the Wonder mine, a gold producer.

CLARK COUNTY

In Clark County the mine production of each of the metals except zinc was less in 1930 than in 1929. The output of ore increased from 7,274 to 10,458 tons, but the total value of the metals decreased from $201,546 to $200,309. Most of the ore was produced from the mines in the Yellow Pine district.

Eldorado Canyon district.—Two lode mines in the Eldorado Canyon district produced 3,350 tons of ore yielding gold, silver, copper, and lead, valued at $28,629, or $8.55 in metals a ton. The larger part of the output was gold and silver bullion recovered from the property of the Eldorado Rand Mining Co. A small lot of rich concentrate, containing gold and silver with a little copper and lead, was shipped to a smelter in Utah. The Techatticup mine was operated by lessees, and several hundred tons of ore were treated by flotation. Lead concentrates rich in gold were shipped to Utah for smelting.

Searchlight district.—Three lode mines in the Searchlight district produced 124 tons of ore yielding $401 in gold and 27 ounces of silver, valued together at $411, or $3.31 in metals a ton. All the ore was treated by amalgamation or cyanidation and was produced from the Duplex, New Era, and Pompeii properties. A noteworthy development was the construction of a 100-ton flotation mill by the Searchlight Gold Corporation to treat ore, chiefly from the Duplex mine. Tests were made with amalgamation prior to equipping the mill for flotation, and although completed in September the mill did not begin regular operations until March, 1931. The machinery installed consisted of 1 Universal jaw crusher, 1 Roy & Titcomb ball mill, 1 Dorr Duplex drag classifier, 1 Denver Sub-A flotation machine, 1 Oliver filter, and 1 Dorr thickening tank.

Yellow Pine district (*Goodsprings*).—Eleven lode mines in the Yellow Pine district produced 6,984 tons of ore yielding $1,495 in gold, 1,031 ounces of silver, 18,065 pounds of copper, 965,226 pounds of lead, and 2,474,323 pounds of zinc, valued in all at $171,269, or $24.52 in metals a ton. The value of the district output increased from $161,320 in 1929. A total of 989 tons of ore was milled; it yielded 42 tons of lead concentrates shipped to a lead smelter and an unknown quantity of lead-zinc concentrates. The jig material and oxidized lead-zinc ore, amounting in all to 5,516 tons, were sold to eastern pigment plants. The Yellow Pine Mining Co. continued shipments of mixed lead-zinc ore to the Ozark Smelting & Mining Co. at Coffeyville, Kans., with which it had a contract to deliver 600 tons monthly; it had another contract with a Utah smelter for its straight lead ore and concentrate. The company reported a reserve of about 100,000 tons of low-grade lead-zinc ore in the mine and on the dumps. A new 100-ton flotation mill at Goodsprings was completed and in operation 15 days before the close of the year. The mill is furnished with power from a 360-hp. Diesel engine and is equipped with a Symons cone crusher, 1 Hardinge ball mill, 1 Akins classifier, 2 Deister double-deck concentrating tables, 6 Fagergren flotation machines of 100-ton capacity, 1 Oliver filter, 2 Dorr agitation tanks, and 2 Dorr thickening tanks. The ore is delivered to the mill over a 4-mile narrow-gage railroad. From the Anchor property lessees shipped first-class oxidized lead-zinc ore to the Ozark works in Kansas. The Anchor 75-ton gravity concentration mill was not operated. It is equipped with a Davis crusher, 1 trommel, 1 set of rolls, 2 Wilfley tables, and 1 Hartz jig. The ore is crushed to minus ½-inch mesh, jigged, and the fines passed over the tables. The mine is opened by a 500-foot inclined shaft. The Argentena property was in operation until the end of July and produced 25 car lots of mixed lead-zinc and zinc ore. Both kinds of ore were shipped to one of the eastern plants of the Grasselli Chemical Co. A lessee at the Boss mine shipped 5 tons of copper ore to the smelter at Garfield, Utah. The ore usually contains some of the platinum metals. The Commonwealth Mining Co. was engaged in building a mill for treating gold ore from the Keystone mine by amalgamation and the sands by cyanidation. Some gold, 0.855 to 0.901 fine, was shipped to the San Francisco Mint. A lessee of the Potosi mine produced some lead ore and zinc ore. The Shenandoah mine produced a car lot of lead ore, one of lead-zinc ore, and some zinc ore.

ELKO COUNTY

In Elko County 29 lode mines produced 63,355 tons of ore in 1930, a decrease of 14,661 tons from the output in 1929. The output of all metals decreased—gold from $717,317 to $469,486, silver from 331,094 to 290,614 fine ounces, copper from 727,768 to 157,323 pounds, and lead from 1,604,176 to 1,298,985 pounds; no zinc was produced in 1930, but 64,124 pounds were reported for 1929. The total value of the metals decreased from $1,127,172 to $666,773.

Contact district (Salmon River).—Eight lode mines in the Contact district produced 1,253 tons of ore yielding $954 in gold, 4,399 ounces of silver, 133,810 pounds of copper, and 71,269 pounds of lead, valued in all at $23,606, or $18.84 in metals a ton. All the ore was sold to smelters in Utah. The value of the district output decreased decidedly from $118,209 in 1929. The Seattle Contact Copper Co. developed its Delano mine and shipped 850 tons of oxidized copper ore containing gold and silver. The Gray claim, which was operated until July, produced about 200 tons of lead and silver ore containing a little copper and zinc; the ore was shipped to International, Utah. The claim is developed by a 140-foot vertical shaft and 180 feet of drifts. The Gray Copper Corporation shipped some copper ore mined during the development of its Palo Alto-Blue Bird group. Five other mines, including the property of the Uvada Copper Co., produced copper ore of shipping grade.

Delano district.—Three lode mines in the Delano district produced 2,098 tons of ore yielding $16 in gold, 49,416 ounces of silver, and 784,258 pounds of lead, valued in all at $58,254, or $27.77 in metals a ton. Nearly all the output was first-class smelting ore from the Net No. 2 mine of the Panther Mines Co. and from the Blue Bell property. Dump ore from the Gold Note and Maybelle property was jigged, and one lot of lead concentrates was shipped as a test. The Panther Mines Co. produced from the Net No. 2 mine 2,000 tons of 22 per cent lead ore containing an average of 25 ounces of silver to the ton. The ore was hauled 35 miles to Montello on the Southern Pacific Railroad. Hauling charges were $7 a ton, and freight to Salt Lake City was $5 a ton. Owing to a scarcity of water the 50-ton gravity concentration mill was inactive for the first time since it was built in 1926. It is situated 8 miles from the mine and is equipped with crusher, trommel, screens, rolls, drag classifier, and 3 Wilfley tables. The mine is opened by a 1,200-foot inclined shaft, is dry, and is well ventilated.

Gold Circle district (Midas).—Three lode mines in the Gold Circle district produced 552 tons of ore yielding $7,824 in gold and 4,216 ounces of silver, valued together at $9,447, or $17.11 in metals a ton.

Most of the ore was treated by amalgamation at the Esmeralda and Queen properties. A lessee shipped some gold ore to a smelter from the Elko Prince property, which was under development. Plans were made to deepen the two shafts.

Jarbidge district.—Three lode mines in the Jarbidge district produced 58,149 tons of ore yielding $460,032 in gold and 225,358 ounces of silver, valued together at $546,795, or $9.40 in metals a ton. The Elkoro Mines Co., the second largest producer of gold in Nevada in 1930, operated the Long Hike, Starlight, and other claims and the 150-ton cyanidation mill throughout the year. The Yukon Gold Co. owns about 60 per cent of the stock of the Elkoro Mines Co., which for the year ended December 31, 1930, reported the production of 57,539 tons of ore averaging $9.53 a ton in gold and silver, compared with 50,458 tons averaging $13.10 in 1929. The net value of the 1930 output was $536,578.18, and after deducting total costs amounting to $358,913.03 a net operating gain of $177,665.15 remained. The printed report of the company[6] says:

> While a greater tonnage of ore was mined and milled in 1929, not only at a reduced cost per ton but with equally good metallurgical recovery of gold and silver, the lower grade of the ore and the decline in the price of silver combined to reduce operating profit. The development work done during the year under review failed, as was the case in 1929, to add to the ore reserves; and it appears, therefore, that the mine will be exhausted by the end of 1931, unless additional ore be meanwhile developed. Exploration work in search for new ore bodies is being actively prosecuted.

The Bluster and Success properties were worked by lessees, and gold ore was treated by amalgamation in the mill at the Bluster mine.

Kinsley district.—Three lode mines in the Kinsley district produced 66 tons of first-class smelting ore yielding $32 in gold, 348 ounces of silver, 8,320 pounds of copper, and 2,174 pounds of lead, valued in all at $1,357, or $20.56 in metals a ton. A lessee worked the Bessie Turner claim and produced 22 tons of copper ore and 4 tons of lead ore, shipped to Garfield and International, Utah, respectively.

Merrimac (*Lone Mountain*) *district.*—The Alaska Improvement Co. owns the Rip Van Winkle property on the west slope of Lone Mountain 30 miles north of Elko. Table concentration of the low-grade lead ore was tried in 1930, but tests made by flotation at the International mill near Tooele, Utah, proved successful. A 30-ton flotation plant was then built at the mine, and it was reported nearly complete in November. Winter weather prevented necessary supplies and machinery from reaching the mill, located at an altitude of 8,000 feet. The mill equipment consists of coarse and fine grinding machinery and five Kraut cells. The Rip Van Winkle mine is opened by a crosscut tunnel and drift on the vein, totaling about 1,300 feet. Lessees working at the mine since 1925 have produced each year a few lots of lead ore shipped to Utah.

Rowland district.—The Bruneau Consolidated Gold Mines, operating a lode mine 96 miles north of Elko and southeast of Jarbidge, did 200 feet of development work and produced a small lot of bullion through the operation of a 30-ton amalgamation mill on the property. Three Devereaux agitators were added to the mill in 1930.

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[6] Yukon Gold Co. 22d Ann. Rept., for year ended Dec. 31, 1930.

Spruce Mountain district.—Five lode mines in the Spruce Mountain district produced 1,122 tons of ore yielding $43 in gold, 6,403 ounces of silver, 15,193 pounds of copper, and 404,014 pounds of lead, valued in all at $24,684, or $22 in metals a ton. The entire output was first-class ore shipped to smelters in Utah. The largest producers were the Nevada Lead & Zinc, Humbug, and Bullshead properties. The property of the Nevada Lead & Zinc Co. was closed early in the year owing to low metal prices; but up to the time of closing the company produced 979 tons of oxidized lead ore containing silver, a little copper, and gold. The property is opened by a 300-foot vertical shaft, 4,000 feet of drifts, and a tunnel 500 feet long.

Tecoma district.—Oxidized lead and silver ore was shipped from the Jackson mine leased to the Alta Tiger Mining Co. The property is opened by five shallow shafts and two tunnels. The deepest shaft is 100 feet and the longest tunnel 1,500 feet. Development in 1930 consisted of 150 feet of drifts and raises.

Tuscarora district.—A little placering was done in the Tuscarora district at the Harris claims 1½ miles west of Tuscarora, but no record was kept of the gold output in 1930. The placers have been worked for a number of years by an operator who uses a Chinese rocker. Horn silver and sometimes native silver are found in ground sluicing; this led the early prospectors to the lodes which became large producers of silver. After lying idle for many years the lodes were under examination in 1930. The Tuscarora Premier Mining Co. did some development in 1930 and at a depth of 172 feet cut a fissure vein 8 feet wide, showing ruby and wire silver. Some work was done in the Navajo mine and North Belle Isle properties.

ESMERALDA COUNTY

The value of the mine production of metals in Esmeralda County increased from $878,932 in 1929 to $1,207,310 in 1930. This output includes that of mines operating in the western part of the Tonopah district. There were good increases in the output of gold and silver but decreases in that of copper and lead. The quantity of ore and old tailings from 27 lode mines increased to 380,236 tons; most of the material was old tailings treated by cyanidation at Goldfield.

Desert district (Gilbert).—Five lode mines in the Desert district produced 414 tons of ore yielding $8,128 in gold, 1,292 ounces of silver, and 4,751 pounds of copper, valued in all at $9,243, or $22.33 in metals a ton. Most of the output was siliceous ore averaging nearly 2 ounces of gold to the ton, which came from the Homestake, Mammoth, and Yellow Rose claims. The ore with some dump material containing copper was hauled by truck 20 miles to a siding on the Tonopah & Goldfield Railroad. The ore amenable to cyanidation was shipped 15 miles by rail to the Desert custom mill at Millers, and the copper ore was shipped to a smelter in Utah. In 1930 trucking, freight, and cyanidation charges at the Desert mill were covered by a flat rate of $8.75 a ton on $30 ore, with an advance of $1 a ton for every $10 increase in value of the ore.

Divide (Gold Mountain) district.—Six lode mines in the Divide district were worked by lessees in 1930 and produced 692 tons of ore yielding $6,317 in gold, 15,874 ounces of silver, and 113 pounds of lead, valued in all at $12,435, or $17.97 in metals a ton. Nearly all the output was gold ore and silver ore shipped to Millers for treatment by cyanidation. The largest producer was the Tonopah Divide, followed by the Brougher Divide, Gold Zone, Divide Extension, and Reorganized Belcher Divide properties. A small test lot of lead ore was shipped from the Silvia No. 2 claim.

Goldfield district.—Ore from two lode mines and old tailings from the dump of the Goldfield Consolidated property yielded $297,732 in gold, 10,542 ounces of silver, and 8,939 pounds of copper, valued in all at $302,953. This output of metal was contained in 161 tons of gold ore shipped to a custom cyanidation plant near Tonopah, 332 tons of first-class gold ore shipped to smelters in Utah, and 277,000 tons of old tailings treated by cyanidation by Bradshaw (Inc.) at the old Goldfield Consolidated mill. The capacity of the mill was increased to over 1,000 tons a day by the addition of new filters and other improvements. A shortage of water in July retarded operations to some extent, so that the output of gold was not much greater than that of the previous year. Dividends paid in 1930 by Bradshaw (Inc.) amounted to $94,736.88. The Goldfield Deep Mines Co. of Nevada continued development by a shaft sunk 2,750 feet on the Combination claim. The management of the Pittsburgh-Goldfield mine planned to sink a vertical shaft 600 feet, of which over 230 feet were completed.

Hornsilver district.—During development of the property of the Ohio Mines Co. in the Hornsilver district silver ore containing a little gold was shipped to the cyanidation mill at Millers.

Klondyke district.—The output of the Klondyke district consisted of two lots of copper ore shipped to a smelter in Utah and one lot of silver ore shipped to California. Most of the output came from the Cracker Jack and Congo No. 1 properties.

Lida district (Tule Canyon).—A small lot of lead ore containing gold and silver was shipped by a lessee from the Ingalls mine in Tule Canyon 40 miles south of Goldfield.

Palmetto district.—The Lucky Boy and Red Top claims in the Palmetto district were under development, and some gold bullion was produced during experimental work in an amalgamation mill situated about 2 miles from the property on Cottonwood Creek. The mill is equipped with an Ellis crusher, three 1,250-pound stamps, one copper plate, and one Overstrom table.

Silver Peak district.—Five lessees of lode mines in the Silver Peak district reported 2,928 tons of ore yielding $48,083 in gold, 1,338 ounces of silver, and 3,412 pounds of lead, valued in all at $48,769, or $16.66 in metals a ton. Most of the ore was treated in gold and silver mills having flotation equipment. The Mary mine was the chief producer. It is under lease to the Lucky Boy Divide Mining Co., which in turn is controlled by the Black Mammoth Consolidated Co. According to a quarterly report of the company, dated April 22, 1930, it pays a royalty to the parent company ranging from 12½ to 25 per cent, depending upon the grade of ore mined, with a prospect of having the royalty reduced to 8 per cent. In August, 1929, the oil-flotation process was adopted, and the first ore (105 tons) milled yielded $13.58 a ton in gold and silver, leaving 62 cents a ton in the tailings. The second lot of 163 tons of ore averaged $11.63 with 60 cents a ton in the tailings. About 50 per cent of the total recovery was made by amalgamation. The mill equipment consists of a primary jaw crusher, a gyratory reduction crusher, followed by dry crushing rolls and a belt elevator, which places the crushed ore in a fine ore bin ahead of a Hardinge ball mill. The fine ore is fed to the ball mill with a Challenge type ore feeder. The grinding is controlled by a Simplex Dorr classifier operating in a gravity closed circuit with the Hardinge mill. Silvered amalgamating plates follow the classifier, and the pulp then passes to a conditioning tank where flotation reagents are added. Flotation is accomplished in a 50-ton K & K rougher and cleaner. After the flotation treatment in the K & K rougher the pulp is passed over a Wilfley table for final treatment before discharging the waste. The capacity of the coarse and intermediate crushing units is approximately 100 tons, and the ore is finished to a ⅜-inch size. The ball mill is of 30 tons capacity. An automatic sampling device is part of the equipment for sampling custom ores which the Black Mammoth Consolidated Co. treats for various lessees who, until the present time, found no profit in shipping $15 ore from the Silver Peak district. The Silver Peak Reduction Co. treated old tailings by cyanidation at the Fachini mill in October and shipped some gold precipitates. The Valcalda property, which adjoins the Mary mine, was worked in 1930 by the Oromonte Mines Co., and milling was done by the R & K Mining & Milling Co. in a 50-ton plant with equipment and method of treatment similar to that at the Black Mammoth mill. The mill operated four months and treated 958 tons of ore, from which gold bullion and concentrates were recovered.

Tonopah district.—The entire output of ore in 1930 from the western part of the Tonopah district in Esmeralda County was from the property of the Tonopah Extension Mines (Inc.). The figures of output are included in the review of the Tonopah district under Nye County.

EUREKA COUNTY

The mine production of all metals in Eureka County showed decreases in both quantity and value in 1930. The output of ore decreased from 49,311 to 3,521 tons, gold from $49,558 to $16,668, silver from 521,610 to 61,465 fine ounces, copper from 41,917 to 10,784 pounds, and lead from 1,191,478 to 402,977 pounds; no zinc was produced in 1930, but 17,270 pounds were reported for 1929. The total value of the metals decreased from $411,156 to $61,883.

Cortez district.—The value of the mine production of metals in the Cortez district in 1930 was $20,014, a decrease from $305,600 in 1929. This large decrease was due to the closing of the mine and mill of the Consolidated Cortez Silver Mines Co. in January, 1930, owing to low silver prices. After closing its property the company went through receivership proceedings, and a receiver was appointed July 5, 1930. A very interesting paper[7] published by the Bureau of Mines discusses mining methods and costs at the Cortez mine.

Eureka district.—Three lode mines in the Eureka district produced 1,898 tons of ore yielding $14,344 in gold, 17,037 ounces of silver,

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[7] Hezzelwood, G. W., Mining Methods and Costs of the Consolidated Cortez Silver Mine, Cortez, Nev.: Inf. Circ. 6327, Bureau of Mines, 1930, 16 pp.

9,016 pounds of copper, and 365,725 pounds of lead, valued in all at $40,361, or $21.27 in metals a ton. All the ore was of smelting grade, and the entire output was shipped to smelters in Utah. Most of the output of the district was from the Richmond-Eureka property, operated by lessees.

Lynn district.—The Bulldog placer in the Lynn district, about 20 miles north of Carlin, was worked by hydraulic and ground sluicing from March until May and produced 72 ounces of bullion 0.923 fine in gold. About 40 acres of placer ground and 1¼ miles of ditch are owned by the operator of the property.

HUMBOLDT COUNTY

The value of the mine production of metals in Humboldt County in 1930 was $3,947, a decrease of $48,891 from 1929. The quantity and value of each of the metals decreased, and the ore sold or treated decreased from 644 to 294 tons. Most of the output was treated in amalgamation mills; the remainder was shipped to smelters.

Amos (Slumbering Hills) district.—The Old Daveytown amalgamation mill was operated on ore hauled by truck 2 to 4 miles from the Alabama, Daveytown, and Dilworth properties. The mill has a gyratory crusher, 5 Allis-Chalmers 1,000-pound stamps, 3 copper plates, and a Wilfley table.

Cove and Leonard Creek districts.—Placer gold was produced from the Basin claims on Leonard Creek by dry washing methods, and some gold bullion from quartz was treated in the Josie Pearl amalgamation mill. Both districts are situated almost directly south of Denio, Oreg.

Sherman district.—The Basque Mining & Milling Co. operated its property, the Big Four claims 23 miles north of Winnemucca, and produced 221 tons of mill ore. Milling was begun in October in the newly constructed 40-ton amalgamation-concentration plant. The mill equipment consists of a Straub crusher, 2 copper plates, 2 ball mills of the Straub and Hendy type, and 2 Wilfley tables. Gold bullion was shipped to the San Francisco Mint, and concentrates were stored. Eleven sacks of high-grade ore were shipped to Salt Lake City from a 10-inch streak of ore encountered in a raise 500 feet from the portal of the tunnel and 290 feet below surface workings.

LANDER COUNTY

The mine production of metals in Lander County was valued at $220,813 in 1930, a decrease of $373,080 from 1929. The quantity and value of each of the metals except gold decreased. Twenty-four lode mines produced 9,752 tons of ore and old tailings, a decrease of 17,407 tons. The placer production of nine operators was valued at $4,236.

Battle Mountain (Copper Basin, Copper Canyon, Galena) district.—The placers and lode mines in the Battle Mountain district produced 7,236 tons of ore and old tailings, $10,815 in gold, 7,340 ounces of silver, 1,304,984 pounds of copper, and 25,259 pounds of lead, valued in all at $184,552. The ore had an average value of $24.92 in metals a ton. The placer output consisted of $4,223 in gold and 33 ounces of silver, valued together at $4,236. Most of the output was copper ore shipped for smelting; nearly all the remainder was gold ore treated by cyanidation or amalgamation. A little lead ore was also shipped. The principal producing mines are from 7 to 17 miles south of Battle Mountain on the west side of the Reese River Valley in Copper Basin and Copper Canyon. Mining in both camps is controlled chiefly by the Copper Canyon Mining Co., which with many lessees mined ore of uniform shipping grade from veins and deposits in a widely mineralized area. Twenty-five car lots of copper ore, loaded in cars averaging 50 tons to the lot, were shipped by about 55 lessees each month to smelters in Utah prior to the slump in the price of copper. The general average of the shipments was about 10 per cent of copper. In June the ore averaged 12 per cent of copper. Production was reduced in July to 10 car lots by 24 lessees, and because of the lower price of copper the ore was more closely sorted and the grade somewhat higher. One car lot produced from the Sweet Marie shaft contained 19.5 per cent of copper; another lot assayed 17.1 per cent of copper, with 1 ounce of silver and 0.01 ounce of gold to the ton. Three lots shipped from the Henrietta shaft averaged 17 per cent of copper. In September only four groups of lessees were shipping from the Sweet Marie and Henrietta shafts at Copper Basin and from the Virgin and Superior veins at Copper Canyon. The hired-labor account of the company was small, the lessees doing most of the mining. Miners were paid $5.50 a day; as the price of copper fell this was reduced to the Tonopah wage scale of $5.25 for miners and $4.75 for muckers. When copper mining became unprofitable, the Guy Davis and Homestake placers owned by the Copper Canyon Co. were worked by lessees. The placers are in the canyon below the copper mines and are worked from various shafts. Much of the gold is coarse, with nuggets valued at $2 and $6, and it is often encrusted with quartz. One 7-ounce nugget was found. Work at the Dahl drift placer, owned by Good & Kinneburg, was suspended in August, due to a shortage of water, which was diverted to the placer property from the Willow Creek Ranch. At the Old Willow Creek lode mine a hoist was installed, and two small lots of siliceous gold ore were shipped to a Utah smelter. The Modoc and Effie claims 23 miles southwest of Battle Mountain produced gold and silver ore which was treated in a plant equipped with an Ellis ball mill and amalgamation plates. The Modoc claim is opened by a vertical shaft 150 feet deep and has a tunnel 150 feet long. Some dump ore from the Honeycomb property of the Buffalo Valley Mines Co. was treated by cyanidation. From the Ruth or Mesa copper claim, opened by a shaft and 250 feet of drifts, some copper ore of shipping grade was produced. The property of the Imperial Gold Mining Corporation at Galena, 14 miles south of Battle Mountain, was turned over to the Treadwell Yukon Co. (Ltd.) for development of a mineralized belt of altered quartzite said to be 75 to 100 feet wide. The report [8] of the company for 1930 states:

> Options have been secured on 31 groups of claims. * * * The mining chances on these claims lie in finding large bodies of ore assaying from $2 to $3 gold over widths that will make cheap mining costs possible. A small crew

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[8] Treadwell Yukon Co. (Ltd.) Ann. Rept. for year ended Dec. 31, 1930.

is now engaged in driving crosscuts at frequent points, and the assay results from these crosscuts will determine whether or not further work should be done.

Bullion district.—The " Gold Quartz " property near Tenabo was worked by a lessee, and three lots of first-class gold ore were shipped to smelters in Utah.

Hilltop district.—Flotation equipment was added to the Hilltop mill in Golden Rule Gulch in the Hilltop district. The mill was operated about one month in 1930, testing ore from the Hilltop mine. About 30 tons of siliceous gold ore were sorted from the mine dumps and shipped by lessees to a smelter.

McCoy district.—Producers in the McCoy district shipped 271 tons of ore to smelters in Utah; smaller lots, aggregating 115 tons, were milled by lessees in a small custom amalgamation plant. The value of the total output of metals was $16,077, and the average per ton in gold and silver was $41. The ore in the Gold Dome property occurs[9] along fractures in diorite and in places is very rich but difficult to sort. Several car lots of ore shipped to Utah averaged 2.23 ounces of gold and 12 ounces of silver to the ton, showing some mineralization of lead and copper. Lessees treated the higher grade ore in a small Huntington mill by amalgamation, and the bullion shipped to the mint had an average fineness of 0.311 in gold and 0.667 in silver. The deepest workings of the Gold Dome property are 265 feet, but the best ore was from the 50 and 150 foot levels. Ore discoveries were made on adjoining mining claims in the district, and the McCoy Consolidated Co. was organized. The new company prospected the property and sank a vertical shaft 150 feet. Transportation costs from the McCoy district are high, with a 32-mile truck haul to the railroad in addition to freight charges to destination.

New Pass district.—The New Pass Gold Mines Co. produced gold and silver bullion recovered by amalgamation. The property, known as the Yellow Bull group, is situated in the New Pass Range near the Lander-Churchill County boundary. According to Lincoln[10] the mines were discovered in 1865, and a small stamp mill was moved to the property from Austin in 1868. No record is available of early operations, but in 1918 gold production was recorded from a 100-stamp cyanide mill operated by the Nevada-Austin Mines Co. In July, 1930, a 30-ton amalgamation-gravity concentration mill at the head of New Pass Canyon was put in operation. The mill is equipped with a crusher, Hardinge ball mill, plates, and Deister table.

LINCOLN COUNTY

The mine production of metals in Lincoln County was valued at $2,323,051 in 1930, a decrease of $179,842 from 1929. There were good increases in the quantity of lead and in both the quantity and value of zinc, but decreases in the value of lead and in both the quantity and value of gold, silver, and copper. Five mines produced 119,907 tons of ore, a decrease of 1,103 tons. Most of the output was concentrated; the remainder was first-class smelting ore.

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[9] Nevada Mining Press, July 11, 1930, p. 1.
[10] Lincoln, F. C., Mining Districts and Mineral Resources of Nevada: 1923, p. 114.

Comet district.—One lot of lead ore containing gold, silver, and copper was shipped from the Mountain Lion property in the Comet district, but the chief development of interest was the opening of mining ground by the Pan American Mining Co.[11] The soluble lime bed found here occupies the same stratigraphic position as in the Pioche Hills and is from 50 to 60 feet thick and 260 feet above the quartzite. All the development has been in low-grade ore averaging 4 ounces of silver to the ton, 3 per cent of lead, and 5 per cent of zinc, with about 2 per cent of manganese. The chief minerals are sphalerite, galena, pyrite, and manganosiderite. The Comet and Forlorn Hope properties are north of the Pan American group and in similar ground.

Ferguson district.—The Delamar Gold Extraction Co. started work by sampling a large dump of old tailings, 16 miles from Caliente. No production was reported.

Groom district.—Two lots of lead ore from the Groom mine were shipped to a smelter in Utah.

Jack Rabbit district.—The Bristol Silver Mines Co. in the Jack Rabbit district was the third largest producer of copper and lead in Nevada in 1930 and ranked fourth in the production of silver. The company reported an output of 41,250 tons of ore. The property[12] of the Bristol Silver Mines Co. is on the west flank of the Bristol range, about 23 miles by auto road northwest of Pioche. The shaft is connected with a narrow-gage railroad at the Jack Rabbit property on the east side of the range and with a rope tramway over the hill. The property has been a producer since 1860. Most of the ore produced from the mine is oxidized and contains lead, silver, and a little copper; it occurs in fissures in the limestone associated with the May Day fissure system. The mine is opened by a 1,200-foot inclined shaft which is in limestone, and the bottom is not far above the soluble lime bed which has been opened in the Combined Metals mine at Pioche. The Jack Rabbit mine or Black Metals property, a producer of manganese ore during the World War, has been idle for several years.

Pioche district.—The output of the Pioche district consisted of 78,534 tons of lead-zinc ore from the property of the Combined Metals Reduction Co. The property was the largest producer of lead and zinc in Nevada in 1930 and ranked third in the production of silver. The Combined Metals (Inc.) was formed in 1917; in 1923 the Combined Metals Reduction Co. was organized to operate the mine, mill, etc., of the Combined Metals (Inc.) and transferred 75 per cent of its stock to the National Lead Co. In addition to the bond and lease on the Panaca group of the Amalgamated Pioche Mines & Smelter Corporation and other leased ground the Combined Metals Reduction Co. owns over 3,000 acres of mining ground in the vicinity of Pioche. The old shaft (No. 1), sunk 1,600 feet in quartzite by the Amalgamated Co., is used in working the recently developed limestone ore bodies. Replacement ore bodies were found in a soluble lime bed 50 feet thick west of the shaft, forming a part of the Pioche shale series. The ore recently mined is chiefly from mining ground owned by the company, as all the leased ground of the Panaca and part of the Raymond Ely group is practically worked out. To develop the property west of No. 1 shaft and lower the costs of handling ore the Castleton 4-compartment 1,400-foot vertical shaft was sunk. This shaft connects with the 1,400-foot level from old workings opened by shaft No. 1, situated about 1½ miles to the east. All material will eventually be handled through the Castleton shaft. At present the ore is loaded at Pioche and shipped to the Combined Metals selective flotation plant near Stockton, Utah. The present process of treating the ore is a development of other processes since the completion of the mill in May, 1924. In addition to the Nevada ores of the company, custom ores are handled from Utah and adjoining States. The mill[13] has a capacity of 750 to 800 tons of ore a day, of which more than one-half is from the Pioche property. Assays of the ore milled averaged about 8 ounces of silver to the ton, 8 per cent of lead, and 18 per cent of zinc, and the ore requires extremely fine grinding for good separation. The crushing plant was rebuilt late in 1929 and has a maximum capacity of 160 tons, crushing the ore to ⅜-inch size. The flotation plant is in three sections. Sections 1 and 2 consist entirely of Fagergren machines, both rougher and cleaner, on both lead and zinc circuits, and they have a capacity of about 225 tons per day each. Section 3 was added late in 1929 and consists of Fahrenwald lead roughers, Fagergren zinc roughers, and Fahrenwald cleaners on both circuits. Section 3 has a capacity of about 300 tons a day, the capacity being limited by flotation rather than by grinding. No ore was produced from the mines of the Pioche Mines Consolidated (Inc.), which owns nearly 6 miles of contiguous ground on the northeast side of the Pioche Hills. The company also leased some ground from the Amalgamated Pioche Mines & Smelter Corporation. The property is opened by many shafts. Much of the ore is oxidized, occurs in fissures in quartzite associated with porphyry dikes, and contains lead, silver, and considerable gold. The present company has never shipped direct smelting ore, although small lots were recovered by a former company in 1910 and 1919 from the Volcano claims. The small table and flotation concentrator, operated during 1929, was destroyed by fire late in 1929, and a new 500-ton mill building designed for use of tables and flotation was erected in 1930 but no equipment installed. The crushing plant on the property was not damaged by fire and consists of a stationary grizzly, gyratory crusher, elevator, 4-foot trommel with ½-inch screen, 2 Traylor rolls in closed circuit with trommel, and conveyor belt to weightometer to 500-ton steel ore bin in main mill building.

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[11] From notes by T. H. Miller and C. N. Gerry, Bureau of Mines.

[12] Notes furnished by C. N. Gerry and T. H. Miller, Bureau of Mines.

Tem Piute district.—One car of silver ore containing a little gold and copper was shipped by a lessee from the Tem Piute claim 80 miles southwest of Caliente.

LYON COUNTY

The value of the mine production of metals in Lyon County decreased $587,695 from that in 1929, a larger decrease than in any county except White Pine. The decrease in value was due chiefly to the closing of the mines at Mason Valley and the lessened output in the vicinity of Silver City.

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[13] Notes by R. L. Kidd and T. H. Miller, Bureau of Mines.

Palmyra district (Como).—Activity at the Pony Meadows mine 3 miles east of Como was devoted to development and tests on ore in a small amalgamation gravity concentration mill. As only 75 per cent of the gold was saved by amalgamation, a flotation unit was added which improved the metal recovery. Some gold bullion and concentrates rich in gold were shipped. In addition to a Dodge crusher and 2 Hendy 1,250-pound stamps, the new equipment consisted of a Marcy ball mill, Dorr drag classifier, 8 Kraut cells, 1 filter of 24 leaves, and a Dorr thickening tank. The results of the flotation tests were not reported. The Como Mines Co. cleaned out the old workings of the Como mine, timbered and lengthened its main adit which is 3,500 feet long, and developed the Como and North Rapidan veins.

Silver City district.—Two placers and eight lode mines in the Silver City district produced 1,575 tons of ore, $13,323 in gold, and 426 ounces of silver, valued together at $13,487. All the ore was treated by amalgamation and the current sands by cyanidation; the ore had an average recovery value of $8.36 in metals a ton. There was considerable mining activity in the vicinity of Silver City; 40 or 50 lessees worked in the mines and treated siliceous gold and silver ore in the two custom mills, which operated at times from 10 to 12 hours a day. The Pioneer Mines Co. produced ore from the Table Mountain and Byers & Murphy mines and operated the McTigue 15-stamp amalgamation mill built in 1898. Siliceous gold and silver ore from the Flora Temple, Haywood, and Oest mines was treated in the Trimble 18-stamp mill equipped with amalgamating plates. Lessees worked each lot of ore through the mill, cleaned up the copper plates, and usually sold the tailings to the Donovan cyanide plant situated below the Trimble mill. Small lots of dry gold ore produced from the Globe, Grass Widow, Pedroli, and Spring Valley claims were also treated in the local custom mills. Small lots of placer gold were produced from Gold Canyon.

Talapoosa district.—The mine and mill of the Appian Mines Co. in the Talapoosa district was operated by lessees, who produced 774 tons of dry silver ore. This ore was reduced to 13 tons of concentrates containing 9.7 ounces of gold and 79 ounces of silver to the ton and a little lead. The mine is opened by a 750-foot tunnel; the mill is equipped for treatment by concentration with 1 Universal jaw crusher, 1 Marcy ball mill, 1 drag classifier, and 1 Wilfley table. The Nevada Valleys Power Co. supplies the electric power for the mill. The property is 15 miles southwest of Fernley.

Yerington district.—The value of the metal output of the Yerington district decreased from $580,546 in 1929 to $31,509 in 1930. Five lessees worked part of the year mining copper ore from the abandoned Mason Valley group of claims owned by the Eastern Iron & Metal Co. of Salt Lake City, Utah. The ore, closely sorted and averaging about 8 per cent of copper, was shipped to a smelter in Utah.

MINERAL COUNTY

In 1930 the quantity and value of each of the metals produced in Mineral County decreased, the total value being $47,190 less than that in 1929. Most of the ore was treated in gold and silver mills. the remainder was first-class smelting ore.

Bell district (*Simon*, *Mina*).—The Simon Silver-Lead Mines (Inc.) at Simon 22 miles east of Mina produced no ore in 1930 but confined its activities to development and prospecting for new ore deposits. Two important ore bodies were found by sinking a winze from the 800-foot level, and a crosscut on the 900-foot level passed through 50 feet of ore on which a drift was extended 100 feet. The new ore was similar in grade to ore milled in the past, except that the silver content was higher. A second winze, known as the "816," was sunk 108 feet. A statement dated May 4, 1931, issued to stockholders says:

> During the year 1930 we made a total footage of 1,342 feet, 928 feet of which was drifting, 157 feet crosscutting, 236 feet winzing, and 11 feet raising. We have developed considerable ore, but it is quite evident that we are not yet deep enough to determine the possibilities of the Simon mine at depth. The winze to the 1,000-foot level is still in ore at the bottom * * *.
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> A drift was run connecting the 808 winze with the 816 winze on the 900-foot level. The main porphyry-limestone contact was followed throughout the drift; and while several minor showings of high-grade ore, rich in copper, were encountered, the only one of particular note was 130 feet northeast from the "816" winze. At this point we encountered some very high-grade ore paralleling the drift for 30 feet. At the northeast extremity of this ore, the ore shoot turns at a right angle and crosscuts to the porphyry hanging wall, a distance of 40 feet. This ore will average 80 cents gold, 13 ounces silver, 10 per cent lead, 6 per cent zinc, and 3 per cent copper. Another drift was run to the southwest from the "816" winze and was in ore for 60 feet, showing some excellent copper assays at this point. The "816" winze continued in ore to 80 feet below the 900-foot level, where it dipped under the ore and continued in limerock to the 1,000-foot level. This ore averaged $1 gold, 7 ounces silver, 8 per cent lead, 5 per cent zinc. On the 1,000-foot level we crosscut through the ore to the porphyry hanging wall and exposed 14 feet of ore on the right wall averaging $1.60 gold, 5 ounces silver, 10 per cent lead, 8 per cent zinc, and 0.2 per cent copper. This ore extended along the hanging wall for 30 feet * * *.

The cyanide mill at Omco treated 500 tons of siliceous gold ore from the Olympic property, and 265 tons of similar ore were shipped to the custom cyanide plant at Millers.

Garfield district.—One lot of siliceous silver ore was shipped to a smelter in Utah from the Mabel mine of the West End Consolidated Mines Corporation.

Pilot Mountains (*Sodaville*) *district.*—A 12-ton Ellis ball mill was installed in May at the Belleville mine in Telephone Canyon southeast of Mina. The mine is opened by tunnels with crosscuts on the vein, which was very rich in places. About 18 tons of ore shipped to the smelter in 1930 netted the owner $250 a ton in gold. The mill was operated only a short time, and a little gold bullion was recovered.

Regent district (*Rawhide*).—The total value of the metal output of the Regent district was $1,214 in 1930. The output consisted of small lots of ore shipped by various lessees.

Silver Star district (*Marietta*, *Black Mountain*, *Gold Range*, *Douglas*).—Three lode mines in the Silver Star district produced 583 tons of ore yielding $6,403 in gold and 561 ounces of silver, valued together at $6,619, or $11.35 in metals a ton. The entire output, except 4 tons of first-class smelting ore, was gold ore treated by amalgamation. The Mary Ann and Douglass properties were worked by lessees during the year and were the largest producers of gold in the district. The Douglass property 6 miles west of Mina was equipped in June with a Lane slow-speed mill, which operated on siliceous gold ore from which about 80 per cent of the gold was recovered by amalgamation. Lessees of the Mary and Ackerman veins shipped siliceous gold ore to the custom cyanide mill at Millers. The Kernick Divide flotation mill at Sodaville was completed late in 1930 to treat ore from the company mine, 4 miles west of the mill. The mill is 4 miles south of Mina on the main highway. The Mineral County Power line supplies electric current at minimum cost. The mill is equipped with 1 Wheeling jaw crusher, 1 Marcy ball mill, 1 Simplex Dorr drag classifier, 1 Plat-O sand table, 1 Oliver filter, 1 Kraut 3-cell unit of the latest model, 1 dryer, 1 agitation conditioner tank, 1 Cone thickening tank, and 1 bucket elevator of 12-tons-an-hour capacity.

NYE COUNTY

The total value of the mine production of metals in Nye County decreased from $1,836,701 in 1929 to $1,464,855 in 1930. There were large increases in the output of lead and zinc but decreases in that of gold, silver, and copper. Forty-one lode mines produced 128,385 tons of ore and old tailings, a decrease of 2,689 tons from 1929. The value of the placer output decreased from $35,123 in 1929 to $29,771 in 1930; most of it came from the property of the Nevada Porphyry Gold Mines (Inc.)

Athens district.—Siliceous gold ore from the property of the Warrior Gold Mining Co. in the Athens district was shipped to the custom cyanide mill at Millers and to a smelter in Utah. The ore averaged about 1.5 ounces of gold and less than an ounce of silver to the ton.

Bellehelen and Clifford district.—The Western Gold (Inc.) succeeded the Clifford Gold Mines Co. and the Bellehelen Merger Mines Co. in January. The Clifford mine, 35 miles east of Tonopah, was worked by lessees in 1930; the Bellehelen property, 9 miles east of Clifford, equipped with a cyanide mill, was idle. Over 260 tons of siliceous ore averaging about 2 ounces of gold and 4 ounces of silver to the ton was hauled by truck to Millers for treatment by cyanidation, and some ore was shipped by rail from Tonopah to a smelter in Utah.

Bullfrog district (*Beatty*).—Three lode mines in the Bullfrog district produced 282 tons of ore yielding $2,694 in gold and 563 ounces of silver, valued together at $2,911, or $10.32 in metals a ton. The producers were the Pioneer, Original Bullfrog, and Rhyolite Consolidated properties. Ore from the Pioneer and Bullfrog yielded some gold bullion. Concentrates from the Pioneer ore were not shipped. The Rhyolite Consolidated shipped one lot of gold ore for a test and expected to build a mill. The Gold Ace Mining Co., organized about three years ago to develop what was then known as the Bull Moose mine south of Beatty, built a mill which afterward proved a failure, and the machinery was sold. Some gold bullion was produced in 1929, and in 1930 the property was under development by the Beatty Gold Mines & Milling Co.

Cloverdale or Golden district.—A little gold ore from the Golden claims was treated in a small tube mill on the property.

Ellendale district.—One small lot of ore from the Nay prospect in the Ellendale district was hauled by truck to the custom cyanidation plant at Millers.

Fairplay (Goldyke) district.—One car of ore containing $5 in gold and 2 ounces of silver to the ton and a little lead was shipped from the Lucky Jim and Brookland group. Six tons of siliceous gold ore containing 2.74 ounces of gold and 166 ounces of silver to the ton was shipped from the Valcalda property to a smelter in Utah.

Johnnie district.—A lessee on the Johnnie mine recovered a little gold by amalgamation.

Longstreet district.—The Golden Lion Mining & Milling Co. working a property in Longstreet Canyon 52 miles east of Tonopah completed a cyanidation plant and treated about 1,000 tons of $10 ore during the short time the mill operated. Gold and silver bullion was shipped to the San Francisco Mint. The mine is opened by a 450-foot tunnel; the mill equipment consists of 2 Diesel engines, 1 jaw crusher, 1 Joshua Hendy ball mill, 3 thickeners, 1 Oliver filter, 2 agitation tanks, 3 launders for zinc shavings, and a complete outfit for melting bullion.

Mammoth district.—At the Illinois mine some high-grade silver-lead ore was mined from the 300-foot level but was not shipped.

Manhattan district.—Ten placers and 10 lode mines in the Manhattan district produced 5,208 tons of ore and old tailings, $82,746 in gold, and 776 ounces of silver, valued together at $83,045. The ore had an average value of $15.35 in metals a ton. Most of the ore was shipped to smelters in Utah and California; 1,397 tons of ore and 500 tons of old tailings were treated in gold and silver mills. The placer output consisted of $3,097 in gold and 70 ounces of silver, valued together at $3,124. The Manhattan Gold Mines Co., operating the Sunday, Wild Fox, and Grey Fox claims, attracted considerable attention by shipping to the Selby smelter in California several car lots and many small lots of very high-grade ore averaging about 16 ounces of gold to the ton. The property is developed through a winze sunk on a fissure in limestone and a raise from the tunnel level and is said to be in a region hitherto unproductive. The White Caps Gold Mining Co. operated its mine until October and produced more than 3,000 tons of ore containing a little less than 1 ounce of gold to the ton. About 15 tons of ore was hauled daily in auto trucks to Tonopah for shipment to a smelter in Utah. Ore averaging $9 a ton in gold and silver from the Manhattan Consolidated property was treated in the War Eagle mill by amalgamation. The Gold Metals Co. developed the Sullivan mine and tested ore in the War Eagle mill and the tailings by cyanidation. Some gold ore was shipped to a smelter. The Nevada Placers (Inc.), controlling 12 placer claims in the Manhattan district, withheld production pending the outcome of a lawsuit brought to settle title to certain claims. A churn drill was operated two shifts a day for five months, putting down 6-inch casing and sampling the ground every 18 inches.

Round Mountain district.—One placer and three lode mines in the Round Mountain district produced 30,583 tons of ore, $197,741 in gold, and 14,074 ounces of silver, valued together at $203,159. The ore had an average value of $5.77 in metals a ton. The total value of the district output in 1929 was $59,295. The Gold Hill Development Co. and the Nevada Porphyry Gold Mines Co. were the chief producers; both companies operated mills, one using cyanidation and the other amalgamation. The latter company also worked its surface ground when water was available for hydraulicking, but work during the season was greatly delayed by cloud-bursts that washed out sections of the pipe line. These water lines are of pipe 15 and 11 inches in diameter and 8½ and 5 miles long, respectively. Plans were formulated, after a thorough sampling of both the underground and the surface ground, for a larger mill to replace the present plant which was built in 1908 and 1910 to treat all material from the property. The gold is free, and the recovery is said to average about 95 per cent. Operation costs are low, milling being less than a dollar a ton, and $5 ore yields a fair margin of profit. Two giants with 2-inch and 6-inch nozzles washed 20 to 40 cubic yards of material an hour during operations in 1930, and altogether about 31,000 cubic yards were handled between January and November. The 100-ton stamp amalgamation mill, situated at the mine shaft, treated during its operation 60 to 70 tons of ore a day, yielding gold and silver bullion 0.555 to 0.621 fine in gold and 0.303 to 0.353 fine in silver. The plant has twenty 1,000-pound stamps, 2 Huntington 5-foot mills, 2 Gates tube mills, and 1 Hardinge mill. The Gold Hill Development Co. started on August 1 to operate its new 100-ton cyanide mill costing $70,000 and added about 500 feet of new drifts and raises to its property. According to newspaper items the company produced a monthly average of $26,000 in gold and silver during the last three months of the year. The mill equipment consists of 1 Blake crusher, 1 grizzly, 1 Allis-Chalmers tube mill, 1 Williamson ball mill, 2 Dorr Duplex and Simplex classifiers, 1 Oliver filter, 3 Dorr agitation tanks, 3 Dorr thickening tanks, and a Merrill zinc-dust precipitation unit.

Silver Bow district.—About 65 tons of ore was sorted and shipped from various mine dumps in the Silver Bow district. Part of the ore was treated by cyanidation at the custom plant at Millers, near Tonopah, and the higher-grade material was shipped to a smelter. The ore averaged $16 in gold and 57 ounces of silver to the ton. The Silver Bow district is 50 miles southeast of Tonopah.

Tolicha district.—Siliceous gold ore, containing 1.64 ounces of gold and 2.7 ounces of silver to the ton, from the Landmark property in the Tolicha district, was shipped to the custom cyanidation mill at Millers, near Tonopah.

Tonopah district.—Twelve lode mines on the Nye County side and one on the Esmeralda County side of the Tonopah district produced 114,499 tons of ore yielding $406,306 in gold, 1,931,194 ounces of silver, 102 pounds of copper, and 389 pounds of lead, valued in all at $1,149,848, or about $10 in metals a ton. This output consisted of 114,365 tons treated by cyanidation and 134 tons of ore of smelting grade. The value of the output from this region in 1929 was $1,462,291. The total output of the district is given in the following table:

Mine production of gold, silver, copper, and lead in the Tonopah district, Esmeralda and Nye Counties, Nev., 1929 and 1930, and total 1904–1930

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	
1929	14	121, 447	$414, 628	1, 965, 595			$1, 462, 291
1930	13	114, 499	406, 306	1, 931, 194	102	389	1, 149, 848
Total, 1904–1930		8, 228, 996	35, 370, 688	161, 637, 756	12, 277	214, 912	143, 128, 401

The Belmont mine was worked more or less continuously by lessees notwithstanding the fact that silver brought lower prices than ever before known. About 30 sets of lessees worked on the property, and many made better than wages besides paying a royalty to the company on the metal content of ore mined. The Tonopah Mining Co. closed its mine on February 18, but reopened it again on October 3 to 25 sets of lessees. According to the annual report of the company[14] all the ore from the mine (7,891 tons) was treated at the company's custom cyanidation plant at Millers and yielded 3,174 ounces of gold and 278,582 ounces of silver. The company purchased 9,662 tons of custom ore, which yielded 4,525 ounces of gold and 261,164 ounces of silver. The Tonopah Extension Mines (Inc.) suspended all mine and mill operations at the end of the year owing to the low price of silver. Most of the ore was mined by the company from its ground in Esmeralda County connecting with the McKane and Victor shafts, 1,650 and 2,000 feet deep, respectively, with the collar of each shaft at Tonopah. Water was held to the 1,680-foot level of the Victor shaft and to the deepest operations on the 1,650-foot level of the McKane shaft. About 3,000 feet of new work was done in 1930, and at the time of closing a large deposit of new ore had been developed. The company reported production of 98,486 tons of siliceous ore, which was treated in its 60-stamp 500-ton cyanide plant. The bullion recovered contained 14,075.25 ounces of gold and 1,401,057 ounces of silver, valued together at $809,951.56, and after treatment and express charges netted the company $788,072.72. Silver was sold at an average of 37 cents an ounce and gold at its standard value. The bullion was shipped to California for refining. No dividends were distributed in 1930.

Tybo district.—The entire metal output of the Tybo district was from the property of the Treadwell Yukon Co. (Ltd.), which operated its mine and 350-ton selective flotation mill continuously during 1930. According to the annual report of the company[15] the ore milled during the year amounted to 74,159 tons, assaying 10.6 ounces of silver to the ton, 6.6 per cent of lead, and 4.6 per cent of zinc. Improvements were introduced in the flotation plant, resulting in a slight increase in the recovery of metals. The lead-silver concentrates shipped to the Selby smelter in California amounted to 5,942 tons, averaging 0.193 ounce of gold and 85.80 ounces of silver to the ton, 63.07 per cent of lead, and 4 per cent of zinc. The zinc concentrates shipped, amounting to 3,542 tons, went to the Sullivan electrolytic zinc plant at Silver King, Idaho. The zinc concentrates assayed 0.045 ounce of gold and 13.33 ounces of silver to the ton, 2.3 per cent of lead, and 48.13 per cent of zinc. Ore reserves at the end of the year were estimated at 231,500 tons, assaying 0.035 ounce of gold and 12 ounces of silver to the ton, 7.5 per cent of lead, and 5 per cent of zinc. Shipments of zinc concentrates ceased in July, and from then to the end of the year the concentrates were stored either at Tonopah or at the mine. During 1930 the mine was opened by 6,355 feet of new development work. The Hales shaft was sunk 122 feet, and at a point 150 feet below the 710-foot level a station was cut. The development work on this level found the downward trend of the Garrett ore shoot, the vein having the same width of 20 to 30 feet that it had on the 710-foot level; the shoot in the block of ground between the two levels is estimated to contain 70,000 tons of ore. Additional ore reserves from the year's development work, totaling 105,000 tons, have been found between the 410 and 560 levels east. A recent Bureau of Mines circular[16] gives details on milling methods and costs at the lead-zinc concentrator at Tybo.

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[14] The Tonopah Mining Co. of Nevada Ann. Rept. for year ended Dec. 31, 1930.
[15] Treadwell Yukon Co. (Ltd.) Ann. Rept. for year ended Dec. 31, 1930.

Union district (Ione).—Two lots of rich silver ore containing gold, silver, and lead were shipped to smelters in Utah from the property of the Shamrock Mines Co., near Ione, and one lot of gold ore was shipped to a smelter in California from the Magmatic group.

Willow Creek district.—The Lincoln Gold Corporation produced gold ore from the Melbourne group of claims near Nyala. The ore was treated in a 15-ton Ellis ball mill equipped with amalgamating plates. Quartz veins carrying free gold closely associated with talc and calcite occur in the property, which is opened by 800 feet of drifts on three levels.

ORMSBY COUNTY

The total metal output of Ormsby County in 1930 comprised gold bullion from old mill cleanings and material from mining property near Gardnerville sold to an ore buyer.

PERSHING COUNTY

In Pershing County 13 lode mines produced 15,778 tons of ore in 1930, an increase of 10,979 tons from 1929. The total value of the metal output (lode and placer) increased $190,286 as a result of the large increase in the production of gold; the quantity of copper increased, but the output of both silver and lead decreased. The placer production was valued at $1,488.

Antelope district.—The output of the Antelope district consisted of shipments of copper ore from the Majuba Hill and Prince of Wales properties. About 117 tons of 13 per cent copper ore were produced from the Majuba Hill mine 18 miles west of Imlay in the Eugene Mountains. The ore was mined by lessees who hauled it 25 miles to Jungo, a station on the Western Pacific Railroad, for shipment to a Utah smelter. The Prince of Wales is an old mine recently opened by a new inclined shaft.

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[16] Blackburn, W. H., Milling Methods and Costs at the Lead-Zinc Concentrator of the Treadwell Yukon Co. (Ltd.) at Tybo, Nev.: Inf. Circ. 6430, Bureau of Mines, 1931, 15 pp.

Arabia district (*Oreana*).—Lessees shipped first-class lead ore from the Electric-Last Chance and Jersey-Montezuma properties to a smelter in Utah. Both shipments contained over 26 per cent of lead and 13 ounces of silver to the ton. The ore also carried a little gold and about 22 per cent of antimony.

Humboldt (*Imlay*) *district.*—Placer gold was recovered in the Humboldt district by dry placering on the D & O claim about 4½ miles southwest of Imlay near the old Imlay mine.

Placerites (*Rabbit Hole*) *district.*—The Nevada-Montana Mining Co. sampled its placer ground, using Chinese rockers, and prepared to pipe water 5 miles to the property for sluicing the gold-bearing material. No gold was produced.

Rosebud district.—One lot of rich gold ore containing silver was shipped from the Jane claim, formerly the Brown Palace, near Sulphur.

Seven Troughs district.—Three lode mines in the Seven Troughs district produced 5,363 tons of ore yielding $220,210 in gold and 22,686 ounces of silver, valued together at $228,944, or $14.90 in metals a ton. Most of the output was that of the Seven Troughs Gold Mines Co., which operated at capacity its new 100-ton cyanidation plant and produced bullion from August 1 to the end of the year. The Seven Troughs mine, 28 miles northwest of Lovelock, is opened by an 11,900-foot adit. New development in 1930 included 3,100 feet of tunnel, 130 feet of shaft, 1,450 feet of crosscuts, 1,900 feet of drifts, 2,900 feet of raises, and 500 feet of winzes. The Seven Troughs mill is supplied with power from a 360-hp. Diesel engine and other equipment consisting of an 8-A Telsmith gyratory crusher, 2 Hardinge ball mills, 2 Dorr drag classifiers, 1 Oliver filter, 4 Dorr agitation tanks, 4 Dorr thickening tanks, 1 Wilfley table, and Merrill clarification and Merrill-Crowe precipitation equipment. The Seven Troughs Extension Mines Co. operated a short time its mine and mill in Stonehouse Canyon, 36 miles northwest of Lovelock, and attempted to treat 75 tons of siliceous gold ore by flotation, for which its mill of 50 tons capacity was temporarily equipped with 6 Groch cells. Subsequent tests were made by cyanidation with better results.

Sierra district (*Sunshine*, *Chafey*, *Dun Glen*).—Five lode mines in the Sierra district produced 190 tons of ore yielding $2,231 in gold and 221 ounces of silver, valued together at $2,316, or $12.19 in metals a ton. Gold ore from the Auburn, Last Chance, Algonquin, and Gold Top properties was treated by amalgamation. One lot of gold ore from the Black Hole mine was shipped to a smelter in Utah. A 12-ton Ellis ball mill and amalgamating table was installed in September at the Auburn mine, and some mine-dump material averaging about $4 a ton in gold was treated. Some ore from the old mine workings averaged much higher in gold. Water for the mill is conveyed in a 2-mile pipe line to the property.

STOREY COUNTY

Comstock district.—Fourteen producers in the Comstock district reported 6,198 tons of ore yielding $50,352 in gold and 25,296 ounces of silver, valued together at $60,091, or $9.70 in metals a ton. The entire output, except 593 tons of first-class smelting ore, was treated in gold and silver mills. The total value of the district output in

1929 was $127,608. The largest part of the district output was from the property of the Silver Hill Mining Co. The mine is opened by a 300-foot inclined shaft and 1,000 feet of drifts. All the ore was treated in a 10-stamp amalgamation and 30-ton cyanide mill, and about 75 per cent of the gold was saved on amalgamating plates. A good percentage of the remaining values in the sands and slimes was recovered by cyanidation. The Sutro Tunnel Coalition (Inc.) produced some gold and silver ore and continued exploration work in the Middle Mines group at Virginia City and the Gold Hill group at Gold Hill. Important ore deposits were opened in the Middle Mines group. The Crown Point mine at Gold Hill is the most promising of the Coalition holdings, and crosscuts have exposed the ore for a width of 40 to 52 feet. Samples of ore average $10 to $30 a ton, of which two-thirds is gold. Some of the ore mined during development of the property averaged $12 in gold and 20 ounces of silver to the ton and was treated at the custom cyanidation mill at Millers, near Tonopah. The larger part of the output was shipped to Utah. The Flowery Mines Co. is said to have developed ore on the 200-foot level of its property in Six-Mile Canyon, but its mill was not operated. Some ore was treated in a local mill by a lessee of the Lady Bryan property of the Flowery Mines Co. At the Comstock Home property, opened by a 360-foot vertical shaft, additional work consisted of 350 feet of drifts. Some ore assaying 1.3 ounces of gold and 6. 3 ounces of silver to the ton was shipped. All the ore of the Spearhead Gold Mining Co. was treated by amalgamation in a local mill. Some of the ore was from various mine dumps and was treated in small lots at a local amalgamation mill rented to miners, who as a rule milled their own ore and made more than wages in several instances. The bullion recovered from ore in the district ranges in fineness from 0.490 to 0.588 in gold and from 0.376 to 0.488 in silver.

WASHOE COUNTY

The quantity and value of each of the metals except gold decreased in 1930 in Washoe County. The total value of the metal output, however, increased from $5,460 in 1929 to $7,998 in 1930. Eleven lode mines produced 322 tons of ore in 1930, the same quantity that 14 lode mines produced in 1929. In 1930 most of the output was treated by amalgamation; the remainder was first-class smelting ore.

Hooker district.—The Wild Horse claim in the Hooker district or vicinity 4 miles south of Reynard Siding on the Western Pacific Railroad was developed. The claim is opened by a 75-foot vertical shaft and 300 feet of drifts. A 5-stamp amalgamation-concentration mill on the property was operated a short time.

Pearine district.—Three tons of 7 per cent copper ore, containing 111 ounces of silver and nearly $3 in gold to the ton, was shipped from the Gold Bond property to a smelter in Utah.

Pyramid district.—The Blue Bird mine produced one lot of sulphide copper ore containing silver and gold. The mine is opened by a 400-foot tunnel.

Wedekind district.—The Southwest Mines Investment Co. developed the Wedekind property 4 miles east of Reno and proved, with a churn drill, the occurrence of ore at a depth of 335 feet. Assays of the drillings reported by the company ranged from 1.92

to 4.38 ounces of gold and assayed as high as 59 ounces of silver to the ton with some lead and zinc. The mine is opened to a depth of 160 feet by a vertical shaft. It was an important producer of gold, silver, and lead between 1901 and 1910.

White Horse district.—Nine lode mines in the White Horse district produced 301 tons of ore yielding $7,281 in gold and 152 ounces of silver, valued together at $7,340, or $24.39 in metals a ton. All the ore was siliceous and was treated by amalgamation in two Huntington mills; much of it came from the Springfield property, which alone produced more than $3,000 in gold bullion. The mine is opened by two tunnels, 1,200 and 1,500 feet long, and a shaft 345 feet deep. Lessees of other property in the district treated gold ore in the Springfield mill.

WHITE PINE COUNTY

The total value of the mine production of metals in White Pine County in 1930 was $9,598,840 less than in 1929; the quantity and value of each of the metals except silver decreased decidedly. Twenty-five lode mines produced 4,011,625 tons of ore, a decrease of 2,374,595 tons from 1929; most of the output was low-grade milling ore. The placer production was valued at $1,169.

Aurum or Silver Mountain district (*Schellbourne*).—The Piermont mine was the principal producer in the Aurum district in 1930. The company built a 50-ton flotation mill which operated from September, 1929, to September, 1930. The mill is situated at Piermont, 8 miles southwest of Aurum, and is supplied with power by a 340-hp. Diesel engine and a 200-hp. hydroelectric plant. An electric-motor ore tram between mine and mill carries the ore a distance of 1,200 feet. The milling equipment consists of 1 Blake crusher, 1 Symons cone crusher, 1 Leahy vibrating screen, 1 Stearns-Roger ball mill, 1 Model D Simplex Dorr classifier, 1 Minerals Separation Sub-A flotation machine, 1 Dorr filter, 1 Stearns-Roger steam coil dryer, and 3 Flood electric Solenoid samplers. The product from the mill was a high-grade silver concentrate, which was hauled by truck 250 miles to the Garfield smelter in Utah. One lot of lead ore, containing a little silver and copper, was shipped from the Nevada Homestake property in 1930.

Cherry Creek district.—Five lode mines in the Cherry Creek district produced 176 tons of ore yielding $9,528 in gold, 10,751 ounces of silver, 11,181 pounds of copper, and 67,605 pounds of lead, valued in all at $18,501, or $105.12 in metals a ton. Most of the output was produced by a lessee working on the property of the Nevada Standard Mining Corporation, which owns the Mary Ann, Star, and Exchequer claims. The corporation has a flotation mill which was in operation for a short time in 1930, but no production of concentrates was reported.

Duck Creek district.—Three lode mines in the Duck Creek district produced 49 tons of ore yielding gold, silver, and lead, valued in all at $2,656, or $54.20 in metals a ton. Lessees worked the Frederick mine of the McGill Mining Co. and shipped several small lots of lead ore to a smelter in Utah.

Osceola district.—Five placers and one lode mine in the Osceola district produced gold and silver bullion valued at $6,302. According-ing to the Nevada Mining Press of January 24, 1930, a mill run of 38 tons of ore from the Woodman mine of the Nicholson Mining & Milling Co. yielded $2,195.89 in gold and silver recovered by amalgamation in an 8-ton Straub mill. The company is prospecting a gold-bearing fissure in a shale series beneath the productive quartzite. Small lots of placer gold were reported by various lessees.

Robinson district (*Ely*).—The output of gold, silver, copper, and lead from ore reported by eight producers in the Robinson district in 1930 was decidedly less than that reported by five producers in 1929. Most of the ore was from the properties of the Nevada Consolidated Copper Co. and the Consolidated Coppermines Corporation. The district continued as the largest producer of gold and copper in Nevada; its output is indicated in the following table:

Mine production of gold, silver, copper, lead, and zinc in the Robinson district, White Pine County, Nev., 1929 and 1930, and total, 1904-1930

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	5	6,378,138	$1,321,640	204,108	130,754,962	71,094		$24,447,782
1930	8	3,999,077	1,041,668	159,366	105,385,006	59,668		14,806,059
Total, 1904-1930		74,147,682	13,865,539	2,360,303	1,664,870,265	5,011,391	6,070,025	290,909,054

According to the annual report of the Nevada Consolidated Copper Co.,[17] the mines and reduction works in the Robinson district were in continuous operation during 1930 and milled 2,769,471 dry tons of ore from shovel pit and underground workings and 1,076,005 dry tons of custom ore, a total of 3,845,476 tons concentrated (an average of 10,536 tons a day), with a milling cost of 45.77 cents a ton. This cost was exclusive of depreciation and all taxes but included all other expenses. The flotation concentrates produced were smelted with crude ore from the company's mines and ore received from adjoining mines. The production of metal is not given separately by the company but is combined with that of the Ray Consolidated Copper Co. at Ray, Ariz., and the Chino mine at Santa Rita, N. Mex. The average grade of all material milled from the three properties was 1.213 per cent of copper, and the average recovery in the form of concentrates was 86.66 per cent of the total copper content. At the Nevada mine the mining cost of steam-shovel mining, exclusive of depreciation and taxes but including all other expense, was 28.15 cents a ton. The cost of mining underground ores from the Ruth mine was 93.6 cents a ton. These mining costs do not include the usual charge, made at all mines of the company against each ton of ore produced, for prepaid development, or stripping expense, or both. This charge at the Nevada mine was 40 cents a ton for the year. The company report continues:

> At Nevada Mines the concreting of the Monitor Shaft and the excavation of the pocket and station on the B level were completed during the year, and the surface equipment of the Wedge Shaft is now being moved over to the Monitor Shaft. The substantial savings which have been derived else-

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[17] Nevada Consolidated Copper Co. Ann. Rept. for year ended Dec. 31, 1930.

where in the operation of shovel properties through the electrification of equipment and other improvements have rendered it economically advantageous for Nevada to extend its pit program beyond what appeared some years ago to be the probable limits. As a consequence, the Wedge Shaft will no longer be used as the main hoisting shaft for the subsequent mining by underground methods of such of the Copper Flat ore body as remains after the shovel pit is completed. This service will be performed by the Monitor Shaft, and the Wedge Shaft will be used as an auxiliary for ventilation and general utility purposes. A ventilation raise was put up during the year from the underground development workings to the bottom of the pit in order to dry out the ground and preserve the existing drifts; and it will be unnecessary to do any further underground development for some time to come. At the Ruth Mine the main haulage way on the Ninth or final main level was extended to Block 3 early in the year. * * * No major improvements or alterations were made at the McGill concentrator during the year, but experimental work on one mill section has indicated that by some minor rearrangements, when opportune, of the existing equipment a small increase can be secured in both mill recovery and grade of concentrates. This research is being continued in order to develop the possibilities to their fullest extent before modifying other sections. * * * Two reverberatory furnaces were in commission until June 16, and thereafter and for the balance of the year only one furnace was in service. The new Cottrell plant completed its first year of operation and measured up to expectations in every respect. The operating and maintenance cost of the Cottrell plant for the year was approximately one-third of the maintenance cost of the old flue system. As is usual, some minor alterations and improvements were made to the smelting plant, but no expenditures were incurred for major additions or betterments. * * * The electrification of the shovel equipment will be commenced in the current year and continued as rapidly as economic and other conditions permit. Some renovation is being done in the McGill power plant in overhauling old equipment in order to improve the efficiency of the plant as a whole.

The Nevada Northern Railway (standard-gage) connects the producing mines with McGill 26 miles distant, to which the ore is conveyed for milling and smelting. Dividends aggregating $360,000 were paid by the railway company and are included in the income of the owner, the Nevada Consolidated Copper Co. Dividends distributed to stockholders in 1930 by the Nevada Consolidated Copper Co. for its Nevada, Arizona, and New Mexico properties combined amounted to $7,893,056.92; the total paid from the earnings of the three properties to the end of 1930 amounted to $144,856,430.25.

The Consolidated Coppermines Corporation had a larger output of metals in 1930 than in any year in the history of its mines. According to the company's annual printed report,[18] it produced 1,114,678 dry tons of ore, which yielded 32,612,203 pounds of copper, 13,917.59 ounces of gold, and 32,157 ounces of silver, valued in all at $4,585,672. All the ore produced was shipped to the mill and smelter of the Nevada Consolidated Copper Co. at McGill and is detailed in the report, as follows:

Ores were shipped from the Emma Nevada, Morris-Brooks, Old Glory, Alpha, and Richard mines. In addition, a small quantity of ore was mined from our claims by Nevada Consolidated Copper Co. with steam shovels. During the early part of the year production from the Morris-Brooks mine was gradually decreased, with corresponding increase from the Emma Nevada, and during the greater portion of the year the entire production of concentrating ores was produced from the Emma Nevada mine. The Alpha mine was the principal source of the Alpha smelting oxide ore produced during 1930. On account of low metal prices, production from Alpha was reduced August 1 to minimum requirements necessary for proper maintenance of workings. The average grade of Alpha ore produced in 1930 was 7.7 per cent copper, compared

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[18] Consolidated Coppermines Corporation Ann. Rept. for year ended Dec. 31, 1930.

> with a 5.37 per cent copper produced in 1929. Direct smelting sulphide ores were shipped from the Old Glory mine up until June 1, when these operations were suspended, pending a more favorable copper market * * *.

Development work in 1930 consisted of sinking an inclined ventilation shaft 411 feet, 9,845 feet of drifts, 456 feet of crosscuts, and 13,308 feet of raises. The cost of material mined was $1,710,362, freight on ore $236,258, milling and smelting $1,248,299, and refining and freight on blister copper $564,286, or a total of $3,759,205. The net profits, including miscellaneous income but deducting depreciation and Federal income tax, were $683,540. The corporation now owns in the Robinson district 252 patented mining claims and 57 unpatented claims, comprising 4,366 acres; it also owns 5,750 acres of surface and ranch lands as well as two valuable water rights. New ore was added to the estimated reserves by churn drilling in the Emma Nevada area. The report continues:

> During the past year the geologic study of the corporation's extensive holdings was actively continued. A particularly detailed examination, both surface and underground, was made in the Minnesota area, and deep churn drilling has accurately checked the work with highly encouraging results. This development is particularly important when it is recalled that in the past only shallow, secondary ores were explored and mined in this ground and that no prospecting was carried on below the zone of pronounced secondary enrichment. The geologic study indicated the possibility of extensive primary mineralization at considerable depth, and deep churn drilling was conducted accordingly. Two holes put down to date have cut a primary ore body varying in thickness from 185 feet to 305 feet, and one of the holes cut a higher-lying secondary ore body of 150-foot thickness. Structural features favor the extension of the primary ore body throughout the claim and beyond it. Churn drilling was done on a reduced scale in the Emma Nevada area, where important additions have been added to our reserves of porphyry ore. The limits of this mineralization have not yet been reached, and drilling is being continued. Geologic study during the past year, along with knowledge gained from prospecting and development, has served to emphasize strongly the relation of the mineralized zones to the major and minor structures of the district. Inasmuch as strong outcrops to our important ore bodies are the exception rather than the rule, structure becomes a very important guide to direct our prospecting. Detailed geologic study of these features will be continued during the coming year, especially in our recently acquired claims. The churn drilling and development in the Emma Nevada territory, since the date of the last annual report and to the beginning of this year, have proven approximately 5,000,000 tons additional ore, and further additions are expected. Sufficient drilling in the Minnesota territory has not as yet been done on which to base any tonnage calculations, but prospects are favorable for the development of an ore body of major importance. As of January 1, 1931, the developed concentrating ore tonnage was in excess of 35 million tons of an average grade as mined of 1.10 per cent copper.

The Smokey Development Co. produced from its claims at Lane 4,455 tons of highly siliceous ore, averaging over $3 in gold a ton, which was used at the smelter for converter lining. The property was recently sold to the Consolidated Coppermines Corporation.

White Pine district (Hamilton).—Six lode mines in the White Pine district produced 720 tons of ore and old tailings yielding $47 in gold, 4,086 ounces of silver, 3,423 pounds of copper, and 109,901 pounds of lead, valued in all at $7,560, or $10.50 in metals a ton. The entire output, except 588 tons of old tailings treated by cyanidation, was first-class smelting ore from the Rocco Homestake, Grand Prize, Peterson, Nevada Lead, and Reck properties. The tailings were from the Treasure Hill mill dump.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH[1]

(MINE REPORT)

By C. N. Gerry and Paul Luff [2]

CONTENTS

Page
Summary 555
Mining industry 561
  Ore classification 562
Metallurgic industry 568
Review by counties and districts 574
  Beaver County 574
  Box Elder County 575
  Cache County 576
  Grand County 576
  Iron County 576
  Juab County 576
    Tintic district 576
  Millard County 585

Page
Review by counties and districts—Con.

  Piute County 585
  Salt Lake County 586
    Bingham or West Mountain district 587
  San Juan County 597
  Sevier County 598
  Summit and Wasatch Counties 598
    Park City region 598
  Tooele County 604
  Uintah County 607
  Utah County 607
  Washington County 608

SUMMARY

The output of gold, silver, copper, lead, and zinc from Utah mines in 1930 was valued at $48,653,464, which was less than the value of any annual output since 1922. In fact it was little more than half the value of the output made by the metal mines of Utah in 1929; the value of the copper alone decreased $32,549,289. The output of gold decreased from $4,969,915 to $4,309,148, silver from 17,592,396 to 13,129,421 ounces, copper from 318,282,523 to 180,526,423 pounds, lead from 298,754,429 to 230,989,780 pounds, and zinc from 103,019,485 to 88,990,938 pounds; the total value decreased from $95,985,201 to $48,653,464.

Compared with other States Utah was first in output of silver in 1930 (as it has been since 1920), third in copper and lead, fourth in zinc, and fifth in gold. Salt Lake County, which includes the Bingham district, again led in total value of metal output in 1930 as well as in production of gold, silver, copper, lead, and zinc. Utah County, which includes part of the Tintic district, was second in total value of the five metals, second also in output of gold, silver, and lead, and fourth in output of copper. Summit County, which includes part of the Park City region, was third in total value of the five metals and third also in output of silver, copper, lead, and zinc. Wasatch County, which includes the remainder of the Park City region, was fourth in total value of the five metals, second in output of zinc, third in output of gold, fourth in output of lead, and fifth in output of copper.

Since 1864 the output of the five metals in Utah has been as follows: Gold, $135,549,002; silver, 577,184,210 fine ounces; copper, 4,565,870,363 pounds; lead, 6,795,237,745 pounds; and zinc, 790,872,004 pounds. The total value of this output has been $1,755,153,612.

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[1] Work on manuscript completed December, 1931.

[2] Assisted by T. H. Miller and Jeannette Froiseth, of the Bureau of Mines.

Published dividends paid by seven mining companies amounted to $19,165,125 in 1930, making a recorded total of $370,475,128 paid to stockholders since mining became profitable in the State. In 1929 dividends paid by 10 companies amounted to $38,467,339. More than 39 per cent (an unusually large part) of the total value of the metal output in 1930 was paid in dividends, and 21 per cent of the metal output since 1864 has been paid in dividends. The dividends stated here for 1930 do not include $2,696,462 paid by the United States Smelting, Refining & Mining Co., which controls mines in other States and in Mexico besides those at Eureka and Bingham, Utah. The seven companies that contributed to the total dividends in 1930 were the Utah Copper, which paid nearly 85 per cent of the total, Tintic Standard, Silver King Coalition, Bluestone Lime & Quartzite, North Lily, Eureka Standard, and Silver Wave (Yankee). The distribution paid by the Silver Wave Mining Co. was not paid from operating profits but from cash received from the sale of the property to the American Smelting & Refining Co.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Utah, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	134	4	2,137,522	85,619.15	$1,769,905	12,251,998	$12,251,998
1922	147	7	5,560,034	111,110.36	2,296,855	17,271,100	17,271,100
1923	146	4	12,752,998	148,824.86	3,076,483	19,137,470	15,692,725
1924	136	2	13,640,618	146,486.85	3,028,152	17,253,692	11,559,974
1925	179	....	14,479,247	177,803.08	3,675,516	21,276,689	14,766,022
1926	164	2	15,856,144	182,762.98	3,778,046	19,358,581	12,079,755
1927	123	....	15,757,074	193,908.82	4,008,451	18,606,950	10,550,141
1928	121	3	18,427,117	212,559.79	4,394,001	17,072,852	9,987,618
1929	127	3	19,831,975	240,419.63	4,969,915	17,592,396	9,376,747
1930	103	....	11,041,841	208,455.03	4,309,148	13,129,421	5,054,827

Mine production of gold, silver, copper, lead, and zinc in Utah, 1921–1930, in terms of recovered metals—Continued

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	30, 891, 403	$3, 984, 991	89, 187, 269	$4, 013, 427	69, 390	$3, 469	$22, 023, 790
1922	97, 193, 850	13, 121, 170	135, 332, 144	7, 443, 268	5, 119, 410	291, 806	40, 424, 199
1923	222, 393, 572	32, 691, 855	203, 447, 793	14, 241, 346	11, 330, 913	770, 502	66, 472, 911
1924	242, 138, 165	31, 720, 100	233, 910, 875	18, 712, 870	18, 562, 172	1, 206, 541	66, 227, 637
1925	236, 486, 540	33, 581, 089	306, 669, 824	26, 680, 275	52, 611, 732	3, 998, 492	82, 701, 394
1926	257, 464, 482	36, 045, 027	295, 270, 025	23, 621, 602	95, 179, 380	7, 138, 454	82, 662, 884
1927	256, 933, 278	33, 658, 259	302, 570, 040	19, 061, 913	99, 185, 443	6, 347, 868	73, 626, 632
1928	293, 235, 039	42, 225, 846	291, 830, 021	16, 926, 141	93, 857, 352	5, 725, 298	79, 258, 904
1929	318, 282, 523	56, 017, 724	298, 754, 429	18, 821, 529	103, 019, 485	6, 799, 286	95, 985, 201
1930	180, 526, 423	23, 468, 435	230, 989, 780	11, 549, 489	88, 990, 938	4, 271, 565	48, 653, 464

GOLD

The production of gold in Utah in 1930 decreased 13 per cent from that in 1929. Further decrease was prevented by the activity at the Eureka Standard mine, the output of which was double that in 1929, and at the North Lily mine, the output of which was greatly increased. Most of the gold came from Salt Lake, Utah, Wasatch, and Juab Counties, named in order of output. The output of gold from Utah County increased more than $600,000, but the output from Salt Lake County decreased nearly $1,140,000; there were also large decreases in Wasatch, Tooele, and Juab Counties. The unusually large decrease in gold from Salt Lake County was due chiefly to curtailment in output of copper ore from the property of the Utah Copper Co. at Bingham. Large increases in output of gold were made by the Eureka Standard, North Lily, Eureka Lilly, Mammoth, Niagara, and United States Smelting, Refining & Mining companies; large decreases were reported from the Utah Copper, Utah-Delaware, Utah-Apex, Park Utah Consolidated, Centennial Eureka, and Tintic Standard properties.

All the gold produced in Utah in 1930 was recovered as a by-product from the smelting and refining of ore and concentrates. Nearly 39 per cent of the gold was derived from copper ore, 27 per cent from siliceous gold ore, more than 17 per cent from lead-zinc ore, and more than 9 per cent from lead ore. The quantity of gold derived from siliceous gold ore was more than double that in 1929, but the quantity derived from copper ore and lead ore was considerably less than in 1929.

The Utah Copper property at Bingham was the largest producer of gold in Utah in 1930, but its output was only a little more than half that in 1929. The Eureka Standard mine near Eureka in the Tintic district was second in gold output, and the North Lily mine, also near Eureka, was third. Other large producers of gold were the mines of the United States Smelting, Refining & Mining Co. at Bingham, the Park Utah Consolidated, Eureka Lilly, Utah-Delaware, Niagara, Chief Consolidated, Bluestone Lime & Quartzite, Utah-Apex, Tintic Standard, Mammoth, and Silver King Coalition, named in order of output.

SILVER

In 1930 Utah was again the largest producer of silver in the United States, as it has been since 1920. The production in 1930, however, was less than any annual output since 1921. The quantity of silver decreased more than 4,000,000 ounces from that in 1929, chiefly as a result of the unusually low price received for the metal. The output in 1930 was considerably less than the record of 21,276,689 ounces made in 1925 but was about 3,700,000 ounces more than the output of Idaho in 1930, which ranked second as a producer of silver in the United States. Salt Lake County led in output of silver, followed by Utah, Summit, Wasatch, and Juab Counties; there were, however, large decreases in each of these counties. The output of many of the large producers decreased considerably, especially that of the Park Utah Consolidated Mines Co., the Silver King Coalition Mines Co., the Utah Copper Co., the Bingham Prospect Mining Co., and the North Lily Mining Co. Good increases were made by the United States Smelting, Refining & Mining Co., Park City Consolidated, Tintic Lead, and Eureka Standard companies. Nearly half the total silver output was derived from lead-zinc ore, more than 25 per cent from lead ore, nearly 17 per cent from siliceous ore, and 7 per cent from copper ore. No refined silver was produced in Utah, as the entire output was recovered at eastern plants from bullion produced at smelters near Salt Lake City.

Nine properties in Utah each produced more than 400,000 ounces of silver in 1930. These were the Tintic Standard in the Tintic district; the Silver King Coalition in the Park City region; the United States mines of the United States Smelting, Refining & Mining Co. at Bingham; the Park Utah mine in the Park City region; the Lark group of the United States Smelting, Refining & Mining Co. and the Utah Copper, both in the Bingham district; and the Plutus, Chief Consolidated, and North Lily mines in the Tintic district.

COPPER

In 1930 Utah dropped to third place among the States as a producer of copper; the output was less than that in any year since 1922. The output decreased from the record of 318,282,523 pounds in 1929 to 180,526,423 pounds in 1930, or 43 per cent. The Utah Copper Co. at Bingham produced about 90 per cent of the State's output of copper in 1930; the company decreased its copper output more than 45 per cent, compared with 1929, as a result of the drastic decline in the price of the metal. Nearly 97 per cent of the copper produced in Utah in 1930 came from the Bingham or West Mountain district, Salt Lake County; the output of copper from the Tintic district, Juab and Utah Counties, and from the Park City region, Summit and Wasatch Counties, was comparatively small.

Crude ore shipped to smelters yielded 10,327,518 pounds of copper, compared with 11,454,902 pounds in 1929. Of the copper from crude copper ore smelted sulphide ores yielded 4,897,072 pounds and oxidized ores 1,059,624 pounds; of the lead ores smelted sulphide ores yielded 711,952 pounds of copper and oxidized ores 246,294 pounds. The copper-lead ores smelted were chiefly sulphide and yielded 1,797,478 pounds of copper. The dry and siliceous ore, used chiefly as a flux at smelting plants, yielded 1,615,098 pounds of copper, compared with 2,155,930 pounds in 1929. The low-grade disseminated ores that were concentrated yielded 160,977,222 pounds of copper, compared with 292,205,094 pounds in 1929. More than 93 per cent of the total recovered copper came from copper ore, nearly all of which was treated by concentration.

The leading copper producers in Utah in 1930 were, in order of output, the Utah Copper Co. (which reported 161,138,717 net pounds, a large decrease from 296,625,554 net pounds reported for 1929), and the Utah-Delaware, United States Smelting, Refining & Mining, Utah-Apex, Ohio Copper, and Silver King Coalition properties. The Utah Copper Co. operated its new precipitation plant at the mouth of Bingham Canyon, but the output of copper from mine-water precipitates was only about one-fourth that in 1929. Development was continued by the Ohio Copper Co. from the Mascotte tunnel at Lark, and the company continued to leach in place the caved area of the mine. The yield of copper from precipitates or cement copper, however, was considerably less than in 1929.

LEAD

In 1930 Utah ranked third among the States as a producer of lead, following Missouri and Idaho. The output decreased from 298,754,429 pounds in 1929 to 230,989,780 pounds in 1930, or more than 22 per cent. The largest decrease was recorded in lead from lead ore of smelting grade. Nearly 59 per cent of the total lead in 1930 came from lead-zinc ore and 37 per cent from lead ore.

The output of lead from the Bingham or West Mountain district decreased from 98,894,016 pounds in 1929 to 85,172,500 pounds in 1930. More than 70 per cent of the lead output at Bingham came from the mines of the United States Smelting, Refining & Mining Co.; most of the remainder came from the Utah-Apex, Utah Copper, Utah Metal & Tunnel, and Bingham Prospect properties. Decided decreases in the lead output of the Utah-Delaware, Utah Copper, Utah-Apex, and Bingham Prospect properties offset the large increase in that of the United States Smelting, Refining & Mining Co.

The output of lead from the Tintic district (Juab and Utah Counties) decreased considerably—from 88,226,699 pounds in 1929 to 58,948,000 pounds in 1930. Large decreases were reported by the North Lily, Tintic Standard, Chief Consolidated, and Victoria mines, but a good increase was recorded from the Eureka Lilly mine.

The production of lead in the Park City region (Summit and Wasatch Counties) decreased from 85,139,968 pounds in 1929 to 61,749,780 pounds in 1930. The output of lead from the Park Utah Consolidated, Silver King Coalition, and New Quincy properties decreased decidedly.

The output of lead from the Rush Valley district, Tooele County, decreased from 23,502,937 pounds in 1929 to 20,313,260 pounds in 1930. The large decrease in the output of lead from the property of the Combined Metals Reduction Co. offset the increase from the Cyclone-Tip Top property of the Bluestone Lime & Quartzite Mining Co.

The output of lead from Beaver County increased from 2,118,175 to 4,082,440 pounds, owing to work at the Horn Silver mine of the Tintic Lead Co. The combined production of the Big and Little Cottonwood districts in Salt Lake County decreased from 346,381 to 250,180 pounds.

The United States Smelting, Refining & Mining Co., operating properties in the Bingham and Tintic districts, ranked first in lead output in Utah in 1930. It was followed in order by the Silver King Coalition mine in the Park City region, the Tintic Standard property (including the Iron Blossom mine) in the Tintic district, and the Park

Utah Consolidated property in the Park City region. Each of these was credited with a production of more than 23,000,000 pounds of lead. Other large producers of lead were the Bluestone Lime & Quartzite, North Lily, Utah-Apex, Eureka Lilly, Combined Metals, Horn Silver, Utah Copper, and Chief Consolidated properties.

ZINC

The production of zinc in Utah in 1930 was 88,990,938 pounds, a decrease of 14,028,547 pounds from the record output in 1929. Utah ranked fourth in zinc production in 1930, following Oklahoma, New Jersey, and Kansas.

The Bingham or West Mountain district, Salt Lake County, and the Park City region, Summit and Wasatch Counties, were the chief zinc-producing areas in Utah. The output of zinc from the Park City region decreased decidedly—from 55,929,712 to 39,085,269 pounds. Unusually large decreases in production of zinc were recorded from the Park Utah Consolidated and New Quincy properties, but the output from the Silver King Coalition mine increased slightly.

The output of zinc from the Bingham or West Mountain district, Salt Lake County, increased from 43,588,545 to 44,724,792 pounds. The large increase in zinc from the mines of the United States Smelting, Refining & Mining Co. more than offset decreases from the Utah-Apex, Utah-Delaware, Utah Copper, and Utah Metal & Tunnel properties.

The large increase in the output of zinc in Beaver County was due to regular shipments of lead-zinc milling ore from the Horn Silver mine of the Tintic Lead Co.; the decline recorded in Tooele County was due to the decrease in the output of lead-zinc ore from the property of the Combined Metals Reduction Co. at Bauer.

The mines of the United States Smelting, Refining & Mining Co. at Bingham, which produced nearly half the total output of zinc in Utah in 1930, ranked first, followed by the Park Utah Consolidated and Silver King Coalition properties at Park City; each of these produced more than 14,500,000 pounds of zinc. Other large zinc producers were the Horn Silver (Tintic Lead Co.), Utah-Apex, Bingham Prospect, Utah Metal & Tunnel, and Honerine (Combined Metals Reduction Co.) properties.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1930, by counties in terms of recovered metals

County	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
Beaver	677.01	$13,995	236,104	$90,900
Box Elder	15.00	310	179	69
Iron	22.01	455	31	12
Juab	12,501.21	258,423	1,561,091	601,020
Millard	2.03	42	65	25
Piute	116.39	2,406	579	223
Salt Lake	105,896.41	2,189,073	3,533,813	1,360,518
San Juan			70	27
Sevier				
Summit	3,536.31	73,102	2,613,652	1,006,256
Tooele	4,359.99	90,129	305,969	117,798
Utah	67,436.34	1,394,033	3,279,117	1,262,460
Wasatch	13,892.33	287,180	1,598,751	615,519
Washington				
	208,455.03	4,309,148	13,129,421	5,054,827
Total, 1929	240,419.63	4,969,915	17,592,396	9,376,747

Mine production of gold, silver, copper, lead, and zinc in Utah in 1930, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	106,900	$13,897	4,082,440	$204,122	3,463,354	$166,241	$489,155
Box Elder	24,008	3,121	5,960	298			3,798
Iron							467
Juab	2,096,892	272,596	9,673,600	483,680	636,230	30,539	1,646,258
Millard	2,938	382	7,760	388			837
Piute							2,629
Salt Lake	175,096,646	22,762,564	85,447,960	4,272,398	44,724,792	2,146,790	32,731,343
San Juan	43,223	5,619					5,646
Sevier			7,520	376	50,042	2,402	2,778
Summit	1,054,992	137,149	36,962,880	1,848,144	16,751,521	804,073	3,868,724
Tooele	222,670	28,947	20,660,980	1,033,049	715,042	34,322	1,304,245
Utah	789,508	102,636	49,353,780	2,467,689	316,209	15.178	5,241,996
Wasatch	623,423	81,045	24,786,900	1,239,345	22,333,748	1,072,020	3,295,109
Washington	465,223	60,479					60,479
	180,526,423	23,468,435	230,989,780	11,549,489	88,990,938	4,271,565	48,653,464
Total, 1929	318,282.523	56,017,724	298,754,429	18,821,529	103,019,485	6,799,286	95,985,201

Ore, old tailings, etc., sold or treated, lode mines producing, and average value of ore, etc., in gold and silver in Utah, 1929 and 1930, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Beaver	10,062	26,699	10	3	$4.30	$3.93
Box Elder	144	132	3	5	.33	2.87
Iron		120		1		3.89
Juab	207,991	159,847	24	21	7.80	5.38
Millard	5	32	1	3	1.60	2.09
Piute	2,552	13	5	2	9.25	202.23
Salt Lake	18,517,039	10,137,056	28	27	.31	.35
San Juan	362	750	1	1	.17	.04
Sevier	43	112	1	1		
Summit	452,398	276,556	6	5	4.15	3.90
Tooele	62,630	45,726	24	15	5.46	4.55
Uintah	10		1		1.50	
Utah	253,086	214,217	16	13	11.00	12.40
Wasatch	325,511	179,831	5	5	5.63	5.02
Washington	142	750	2	1	5.80	
	19,831,975	11,041,841	127	103	.72	.85

MINING INDUSTRY

The mining industry in Utah in 1930 was confronted with the problem of disposing of its products in a declining metal market weakened by an apparent surplus of all metals. The sharp decline in the sale price of the metals, particularly copper and silver, resulted in drastic curtailment at nearly all the larger producing mines and the closing of many of the smaller producers. On the other hand, the mining of gold ore was greatly stimulated, and marked increases in gold output were reported from several mines (chiefly in the Tintic district) which produced ore of smelting grade. Substantial increases were made in the output of lead-zinc ore from the Bingham properties of the United States Smelting, Refining & Mining Co., but these gains were more than offset by large decreases in the output of similar ore from the Park Utah Consolidated, Silver King Coalition, Utah-Delaware, Utah-Apex, Utah Copper, New Quincy, and others. The large decrease in the output of copper was due to rigid curtailment at the Utah Copper mine at Bingham, and there was a corresponding decrease in the associated gold and silver.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Utah, 1921-1930, with content in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
DRY AND SILICEOUS ORE						
1921	376, 472	29, 554. 10	6, 088, 635	1, 371, 654	8, 735, 063	
1922	414, 339	38, 353. 62	8, 110, 733	2, 635, 080	8, 693, 250	
1923	346, 425	32, 714. 51	6, 737, 300	2, 852, 586	6, 358, 703	
1924	282, 226	27, 098. 75	4, 749, 144	1, 998, 016	7, 137, 005	
1925	389, 030	34, 269. 82	4, 434, 524	3, 926, 172	10, 134, 106	
1926	301, 213	24, 097. 08	3, 365, 644	2, 970, 610	6, 408, 867	
1927	245, 344	22, 709. 99	2, 577, 357	3, 072, 539	5, 713, 355	
1928	211, 758	25, 573. 78	2, 355, 975	2, 293, 800	5, 705, 697	
1929	255, 192	26, 172. 76	2, 714, 111	2, 506, 637	6, 564, 788	
1930	223, 010	69, 253. 15	2, 215, 920	2, 066, 018	5, 827, 643	
COPPER ORE						
1921	1, 357, 857	14, 384. 74	229, 556	[1] 27, 321, 481	255, 567	
1922	4, 509, 384	36, 398. 64	473, 284	[1] 91, 088, 007	252, 970	
1923	11, 519, 727	84, 203. 12	867, 618	[1] 214, 305, 888	30, 852	
1924	12, 357, 366	83, 444. 56	887, 541	[1] 234, 954, 343	199, 275	
1925	12, 575, 265	87, 168. 24	[1] 959, 790	[1] 223, 484, 426	701, 063	
1926	13, 949, 866	100, 853. 65	1, 281, 767	[1] 245, 328, 789	582, 261	
1927	13, 879, 173	100, 057. 71	[1] 1, 138, 014	[1] 244, 279, 301	242, 552	
1928	16, 631, 757	115, 164. 28	1, 275, 682	[1] 282, 899, 020	317, 511	
1929	17, 895, 332	137, 353. 04	1, 608, 570	[1] 308, 131, 613	891, 998	
1930	9, 696, 962	80, 953. 27	944, 113	[1] 171, 577, 491	506, 200	
LEAD ORE						
1921	401, 429	41, 628. 44	5, 893, 497	2, 088, 255	79, 519, 436	69, 390
1922	507, 450	17, 853. 25	8, 183, 741	2, 945, 328	107, 416, 311	
1923	645, 991	21, 365. 84	10, 648, 952	4, 494, 047	168, 875, 684	16, 535
1924	729, 219	24, 380. 08	9, 936, 956	4, 138, 013	179, 798, 884	403, 789
1925	699, 361	27, 002. 58	10, 318, 309	5, 874, 744	185, 821, 166	
1926	383, 857	19, 095. 25	7, 307, 599	4, 038, 262	130, 674, 816	
1927	337, 734	19, 868. 69	7, 214, 271	2, 665, 402	131, 088, 261	
1928	341, 194	26, 727. 17	6, 241, 616	2, 430, 055	134, 193, 203	
1929	374, 802	27, 422. 01	5, 281, 243	1, 829, 406	131, 738, 786	
1930	237, 240	19, 660. 23	3, 362, 487	1, 133, 129	86, 489, 490	
COPPER-LEAD ORE [2]						
1921	1, 764	31. 84	40, 309	110, 013	677, 203	
1922	1, 272	35. 14	20, 919	125, 233	137, 399	
1923	971	24. 96	30, 924	90, 624	164, 495	
1924	19	1. 76	462	5, 257	3, 294	
1925	13	. 04	55	1, 370	1, 924	
1927	73, 878	1, 016. 36	169, 111	2, 218, 716	3, 902, 896	
1928	45, 365	1, 632. 79	94, 304	1, 194, 110	2, 905, 485	
1929	44, 219	1, 187. 55	75, 574	883, 605	1, 928, 980	
1930	52, 757	2, 516. 84	127, 468	2, 204, 086	2, 329, 374	
ZINC ORE AND LEAD-ZINC ORE [3] [4]						
1922	127, 589	18, 366. 67	482, 417	400, 202	18, 832, 214	5, 119, 410
1923	239, 884	10, 490. 94	852, 673	650, 427	28, 018, 059	11, 314, 378
1924	271, 788	11, 550. 48	1, 679, 588	1, 042, 536	46, 772, 417	18, 158, 383
1925 [3]	815, 578	29, 362. 40	5, 564, 011	3, 199, 828	110, 011, 565	52, 611, 732
1926	1, 221, 208	38, 700. 84	7, 403, 570	5, 126, 821	157, 604, 081	95, 179, 380
1927	1, 220, 945	50, 256. 07	7, 508, 197	4, 697, 320	161, 622, 976	99, 185, 443
1928	1, 197, 043	43, 415. 77	7, 105, 269	4, 418, 054	148, 708, 125	93, 857, 352
1929	1, 262, 430	38, 238. 02	7, 912, 883	4, 931, 262	157, 629, 877	103, 019, 485
1930	831, 872	36, 071. 54	6, 479, 433	3, 545, 699	135, 837, 073	88, 990, 938

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[1] Includes metal saved from precipitates.

[2] No production reported for 1926.

[3] Includes copper-lead-zinc ore in 1925 as follows: 563 tons yielding 5.07 ounces of gold, 3,957 ounces of silver, 10,194 pounds of copper, 136,737 pounds of lead, and 212,159 pounds of zinc.

[4] No production reported for 1921.

Ore, old tailings, etc., sold or treated in Utah in 1930, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	16	[1] 65,200	56,292.01	433,039	275,736	1,343,692	
Dry gold and silver ore	14	[2] 99,458	9,953.31	626,289	1,336,396	2,078,517	
Dry silver ore	16	[3] 58,352	3,007.83	1,156,592	453,886	2,405,434	
Copper ore	25	[4] 9,696,962	80,953.27	944,113	[5] 171,577,491	506,200	
Lead ore	58	[6] 237,240	19,660.23	3,362,487	1,133,129	86,489,490	
Copper-lead ore	7	[7] 52,757	2,516.84	127,468	2,204,086	2,329,374	
Lead-zinc ore	26	[8] 831,872	36,071.54	6,479,433	3,545,699	135,837,073	88,990,938
	[9] 103	11,041,841	208,455.03	13,129,421	[5] 180,526,423	230,989,780	88,990,938
Total, 1929 [10]	130	19,831,975	240,419.63	17,592,396	[11] 318,282,523	298,754,429	103,019,485

[1] Includes 1 ton of old mill cleanings sold to a smelter.
[2] Includes 51,825 tons of old tailings sold to a smelter.
[3] Includes 915 tons of old tailings and 1 ton of old matte sold to a smelter.
[4] Includes 867 tons of old slag resmelted.
[5] Includes 3,189,620 pounds of copper saved from precipitates.
[6] Includes 565 tons of old tailings sold to a smelter and 660 tons of old tailings reconcentrated.
[7] Includes 5 tons of old slag resmelted.
[8] Includes 100,000 tons of old tailings reconcentrated.
[9] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes. No placers producing in 1930.
[10] Includes 3 placer properties, producing 46.25 ounces of gold and 15 ounces of silver.
[11] Includes 6,812,905 pounds of copper saved from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Utah in 1930, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total
Dry gold ore	65,200	$1,163,659	$166,720	$35,846	$67,184		$1,433,409
Dry gold and silver ore	99,458	205,753	241,121	173,731	103,926		724,531
Dry silver ore	58,352	62,177	445,288	59,005	120,272		686,742
Copper ore	9,696,962	1,673,453	363,484	[1] 22,305,074	25,310		24,367,321
Lead ore	237,240	406,413	1,294,557	147,307	4,324,474		6,172,751
Copper-lead ore	52,757	52,028	49,075	286,531	116,469		504,103
Lead-zinc ore	831,872	745,665	2,494,582	460,941	6,791,854	$4,271,565	14,764,607
	11,041,841	4,309,148	5,054,827	[1] 23,468,435	11,549,489	4,271,565	48,653,464
Total, 1929	19,831,975	4,968,959	9,376,739	[2] 56,017,724	18,821,529	6,799,286	95,984,237

[1] Includes value of 3,189,620 pounds of copper saved from precipitates.
[2] Includes value of 6,812,905 pounds of copper saved from precipitates.

GOLD ORE

Sixteen mines produced 65,200 tons of siliceous gold ore in 1930, compared with nine mines which produced 25,564 tons of similar material in 1929. This large gain was due chiefly to the increase in the shipments of siliceous gold ore from the Eureka Standard mine and to the mining of similar ore from the North Lily property. The metals recovered from gold ore were valued at $1,433,409, an average of $21.98 a ton. The output of ore yielded on the average $17.85 in gold and 6.64 ounces of silver to the ton, 0.21 per cent of copper, and 1.03 per cent of lead. More than 89 per cent of the gold ore was mined from the Eureka Standard, North Lily, and Eureka Lilly properties at Dividend in the eastern part of the Tintic district, Utah County.

GOLD AND SILVER ORE

Eleven mines and three dumps produced 47,633 tons of siliceous gold and silver ore and 51,825 tons of old tailings in 1930, compared with 14 mines which produced 55,001 tons of similar material in 1929. In 1930 the ore and old tailings yielded on the average $2.07 in gold and 6.30 ounces of silver to the ton, 0.67 per cent of copper, and 1.04 per cent of lead; the recovered metals were valued at $724,513, an average of $7.28 a ton. Nearly 44 per cent of the gold and silver material was old tailings shipped from the Eureka Hill dump in the Tintic district, and a large quantity of old tailings was also shipped from the Mammoth dump; most of the remainder was siliceous gold and silver ore from the Mammoth, Chief Consolidated, Victoria, and Centennial Eureka properties, all in the Tintic district, Juab County.

SILVER ORE

Dry and siliceous silver ore and old tailings were produced from 15 mines and 1 dump in 1930, compared with 33 mines and dumps in 1929. The material decreased from 174,627 to 58,352 tons and yielded on the average $1.07 in gold, 19.82 ounces of silver, 7.78 pounds of copper, and 41.22 pounds of lead to the ton. The metals recovered from the ore and old tailings were valued at $686,742, an average of $11.77 a ton. Nine mines and one dump in the Tintic district in Juab and Utah Counties produced 55,704 tons of silver ore and 915 tons of old tailings, or 97 per cent of the total for the State. Nearly 58 per cent of the total silver ore was produced from the Tintic Standard mine near Dividend; most of the remainder came from the Plutus, Chief Consolidated, and Bullion Beck & Champion properties.

COPPER ORE

The output of copper ore decreased decidedly—from 17,895,332 tons in 1929 to 9,696,962 tons in 1930, or nearly 46 per cent. This unusually large difference was due to the drop in the average price of copper from 17.6 cents a pound in 1929 to 13 cents in 1930, which resulted in marked curtailment in the mining of copper ore at the property of the Utah Copper Co. at Bingham. The total copper ore, which represented 88 per cent of the State's output of ore, old tailings, etc., yielded on the average 17 cents in gold, 0.097 ounce of silver, 17.365 pounds of copper, and a little lead to the ton; the recovered metals were valued at $23,952,670, an average of $2.47 a ton. This value represents nearly half the total value of the metal output of the State. Salt Lake County produced nearly all the copper ore, chiefly from the Utah Copper property at Bingham. Other leading producers of copper ore were the properties of the Utah-Delaware Mining Co. and the United States Smelting, Refining & Mining Co., also at Bingham.

LEAD ORE

The metals recovered from lead ore and old tailings produced from 56 mines and 2 dumps in 1930 were valued at $6,172,751, an average of $26.02 a ton, compared with 64 producers and $12,003,283 in 1929. The lead ore and old tailings, which represented 2 per cent of the total output of the State, decreased from 374,802 tons in 1929 to

237,240 tons in 1930. In 1930 the material yielded on the average $1.71 in gold and 14.17 ounces of silver to the ton, 0.239 per cent of copper, and 18.23 per cent of lead. Nearly 62 per cent of the lead ore and old tailings was produced from 16 mines in the Tintic district, 21.5 per cent from 14 mines in the Bingham district, and most of the remainder from 2 properties in the Rush Valley district, Tooele County. Unusually large decreases in the output of lead ore were recorded from the North Lily, Utah-Delaware, Honerine (Combined Metals Reduction Co.), Utah Copper, Bingham Prospect, and Tintic Standard properties, but large increases were recorded from the Utah-Apex and Eureka Lilly properties.

The two largest producers of lead ore in Utah in 1930 were the Tintic Standard and North Lily mines at Dividend in the Tintic district. They were followed in order by the Bluestone Lime & Quartzite Mining Co. at Bauer in the Rush Valley district, the Eureka Lilly mine at Dividend in the Tintic district, the Utah-Apex and Utah Copper properties at Bingham, the Plutus mine in the Tintic district, the Utah-Delaware property at Bingham, and the Chief Consolidated property in the Tintic district.

COPPER-LEAD ORE

Seven properties in 1930 produced 52,757 tons of copper-lead ore and a small quantity of old smelter matte. This material, which increased in output 19 per cent over 1929, yielded on the average 99 cents in gold and 2.42 ounces of silver to the ton, 2.09 per cent of copper, and 2.21 per cent of lead. The metals recovered from the ore and matte were valued at $504,103, an average of $9.56 a ton. Nearly all (96.5 per cent) of the copper-lead ore was produced from the Utah-Apex mine at Bingham.

LEAD-ZINC ORE

All the zinc recovered from Utah mines in 1930 came from lead-zinc ore and old tailings. The output of this material, which represented nearly 8 per cent of the total output of ore, old tailings, etc., of the State, decreased from 1,262,387 to 831,872 tons and yielded on the average 90 cents in gold and 7.79 ounces of silver to the ton, 0.21 per cent of copper, 8.16 per cent of lead, and 5.35 per cent of zinc. The metals recovered from lead-zinc ore and old tailings were valued at $14,764,607, an amount second only to the value of the metals recovered from copper ore, etc. More than 54 per cent of the lead-zinc material came from 9 mines and 1 tailings dump in the Park City region and nearly 41 per cent from 12 mines in the Bingham or West Mountain district; most of the remainder came from 2 mines, 1 in the San Francisco district and 1 in the Rush Valley district. The output of lead-zinc ore and old tailings from the Park City region decreased from 764,747 tons in 1929 to 453,150 tons in 1930. Unusually large decreases in the output of lead-zinc ore were recorded by the Park Utah Consolidated, New Quincy, and Silver King Coalition companies, but a good increase was recorded from the Park City Consolidated property. There was also a considerable decrease in the quantity of old tailings treated during the year. The output of lead-zinc ore from the Bingham district decreased from 475,916 to

338,806 tons. Decided decreases were made from the Utah-Delaware, Utah-Apex, Utah Copper, and Utah Metal & Tunnel properties, but a substantial increase was recorded from the mines of the United States Smelting, Refining & Mining Co. A large increase in the output of lead-zinc ore was also made from the Horn Silver mine by the Tintic Lead Co. Most of the output from the Bingham or West Mountain district and Park City region was concentrated at the custom flotation plants at Midvale, Bauer, and International, where material from Utah and neighboring States was treated at the rate of about 1,900 tons a day. Most of the zinc product from lead-zinc ore was shipped to the electrolytic zinc plants at Anaconda and Great Falls, Mont.; but some of it went to Bartlesville, Okla., East St. Louis, Ill., and Amarillo, Tex. The largest producers of lead-zinc ore in Utah in 1930 were the mines of the United States Smelting, Refining & Mining Co. at Bingham, the Park Utah Consolidated and Silver King Coalition properties in the Park City region, the Utah-Apex mine at Bingham, the Horn Silver (Tintic Lead Co.) mine at Frisco, the Park City Consolidated property at Park City, the Utah Metal & Tunnel property at Bingham, and the Honerine (Combined Metals Reduction Co.) mine at Bauer. Old tailings from Park City were also reconcentrated, but the quantity treated in 1930 was less than half that in 1929.

ZINC ORE

No zinc ore from mines in Utah was treated or marketed in 1930.

Ore, old tailings, etc., sold or treated in Utah in 1930, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	1,684	376.83	8,238	1,480	42,583	
Box Elder	[1] 1	13.06	8			
Iron	120	22.01	31			
Juab	4,548	737.73	14,879	41,876	33,634	
Piute	13	116.39	579			
Salt Lake	616	477.45	5,076	15,639	1,619	
Tooele	2	4.00		9		
Utah	58,216	48,544.54	394,228	216,732	1,265,856	
	65,200	50,292.01	423,039	275,736	1,343,692	
Total, 1929	25,504	20,501.46	212,701	79,139	201,482	

DRY GOLD AND SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Juab	[2] 95,998	8,824.13	573,735	1,309,618	1,923,629	
Salt Lake	3,070	1,071.00	48,944	25,378	143,288	
Utah	390	58.18	3,610	1,400	11,600	
	99,458	9,953.31	626,289	1,336,396	2,078,517	
Total, 1929	55,061	7,331.56	289,478	857,903	296,885	

[1] Old mill cleanings sold to a smelter.

[2] Includes 31,825 tons of old tailings sold to a smelter.

Ore, old tailings, etc., sold or treated in Utah in 1930, by counties, with content in terms of recovered metals—Continued

DRY SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	[3] 1		19	16		
Juab	[4] 22,886	1,236.87	389,913	207,771	911,497	
Salt Lake	86	7.48	1,290	66	936	
Summit	591	22.62	12,288	1,083	8,937	
Utah	33,733	1,698.00	733,810	241,630	1,464,347	
Wasatch	1,055	42.86	19,272	3,320	19,717	
	58,352	3,007.83	1,156,592	453,886	2,405,434	
Total, 1929	174,627	8,279.74	2,211,952	1,569,595	5,706,423	
COPPER ORE						
Beaver	710	16.66	8,243	62,118	37,218	
Box Elder	110	.97	39	23,839		
Juab	[5] 4,905	524.08	55,643	433,136	66,531	
Millard	18	1.98	44	2,938		
Salt Lake	9,689,001	80,227.44	876,830	[6] 170,491,747	397,147	
San Juan	750		70	43,223		
Tooele	498	63.82	2,353	46,711	3,324	
Utah	220	118.32	891	8,556	1,980	
Washington	750			465,223		
	9,696,962	80,953.27	944,113	[6] 171,577,491	506,200	
Total, 1929	17,895,332	137,353.04	1,608,570	[7] 308,131,613	891,998	
LEAD ORE						
Beaver	1,836	54.72	15,939	15,786	550,396	
Box Elder	21	.97	132	169	5,960	
Juab	27,401	1,072.69	499,088	96,542	6,255,715	
Millard	14	.05	21		7,760	
Salt Lake	[8] 52,781	3,361.85	402,992	524,941	14,068,186	
Summit	[9] 922	39.19	20,583	11,500	283,567	
Tooele	34,929	4,175.04	277,320	154,935	18,996,496	
Utah	118,667	10,919.92	2,126,508	321,064	46,091,080	
Wasatch	669	35.80	19,904	8,192	230,330	
	237,240	19,660.23	3,362,487	1,133,129	86,489,490	
Total, 1929	374,802	27,422.01	5,281,243	1,829,406	131,738,786	
COPPER-LEAD ORE						
Juab	17	0.74	267	815	3,101	
Salt Lake	[10] 52,696	2,507.33	125,841	2,198,667	2,311,582	
Tooele	44	8.77	1,360	4,604	14,691	
	52,757	2,516.84	127,468	2,204,086	2,329,374	
Total, 1929	44,219	1,187.55	75,574	883,605	1,928,980	
LEAD-ZINC ORE						
Beaver	22,468	228.80	203,665	25,500	3,452,437	3,463,354
Juab	4,092	104.97	27,566	7,134	479,293	636,230
Salt Lake	338,806	18,243.86	2,072,840	1,842,208	68,525,202	44,724,792
Sevier	112				7,520	50,042
Summit	[11] 275,043	3,474.50	2,580,781	1,042,409	36,670,376	16,751,521
Tooele	10,253	108.36	24,936	16,411	1,646,469	715,042
Utah	2,991	97.38	10,070	126	518,923	316,209
Wasatch	178,107	13,813.67	1,559,575	611,911	24,536,853	22,333,748
	831,872	36,071.54	6,479,433	3,545,699	135,837,073	88,990,938
Total, 1929	1,262,387	38,238.02	7,912,883	4,931,262	157,629,194	102,993,833

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[3] Old matte sold to a smelter.
[4] Includes 915 tons of old tailings sold to a smelter.
[5] Includes 867 tons of old slag resmelted.
[6] Includes 3,189,620 pounds of copper saved from precipitates.
[7] Includes 6,812,905 pounds of copper saved from precipitates.
[8] Includes 660 tons of old tailings reconcentrated.
[9] Includes 565 tons of old tailings sold to a smelter.
[10] Includes 5 tons of old slag resmelted.
[11] Includes 100,000 tons of old tailings reconcentrated.

Zinc products (as marketed from Utah mines and mills) sold to smelters and electrolytic plants in 1930

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of ore or concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Oxidized lead-zinc ore	Sevier	112	56, 866	25. 39	50, 042
Sulphide lead-zinc ore	Beaver	320	206, 080	32. 20	179, 292
Zinc concentrates	Beaver, Juab, Salt Lake, Summit, Utah, and Wasatch.	87, 384	96, 686, 613	55. 32	87, 652, 566
Lead-zinc concentrates	Tooele and Wasatch	1, 127	1, 210, 968	53. 73	1, 109, 038
		88, 943	98, 160, 527	55. 18	88, 990, 938
Total, 1929		105, 758	113, 643, 559	53. 73	103, 019, 485

METALLURGIC INDUSTRY

In 1930 most (95.42 per cent) of the ore and old tailings from Utah mines was concentrated; the resulting concentrates, with the first-class shipping ore, precipitates, other old tailings, etc., were smelted and yielded metals valued at $48,653,464. In the past decade Utah has become an important smelting center, but no refining is done in the State. Large custom copper plants are operated at Garfield and International and lead plants at Midvale, Murray, and International; these smelters are discussed under Salt Lake and Tooele Counties.

There were no important changes in the metallurgical processes used in Utah during 1930. Due to the curtailment in output of ore a few of the larger mills were closed during the year, and others operated on a part-time basis. The Arthur mill of the Utah Copper Co. was closed after a run of three weeks in January, and all the ore from the Utah Copper mine for the remainder of the year was sent to the Magna mill. The Utah-Apex mill at Bingham and the Chief Consolidated mill at Eureka were closed during the summer. The installation of additional crushing and grinding equipment at the Magna and Arthur mills, started in 1929, was completed early in 1930. A few minor changes were made at the Bauer mill of the Combined Metals Reduction Co. and at the Silver King mill at Park City. New mill construction included a 50-ton flotation plant for the Gold Coin Mining Co., operating property near the State line in Iron County, and a small mill at the Mineral Veins Coalition Mines Co. with property at Alta. Each of these new mills was operated a short time during 1930. An experimental plant equipped for leaching and flotation was built by the Ohio Copper Co. to test the large dump of low-grade copper tailings at Lark.

In Utah 19 milling plants were running in 1930; 1 of these used jigs and tables with flotation cells, 1 ordinary table concentration, 2 jigs and ordinary tables, 1 jigs only, and 14 straight flotation. At 2 properties copper was precipitated from mine water or from ore leached in place; most of this copper was recovered at the new mine-water precipitation plant of the Utah Copper Co. near Copperton and at the plant of the Ohio Copper Co. at Lark.

A list of the large mills that were active in 1930 follows.

Large mills in Utah active in 1930

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Class of ore treated	Concentrates produced
			Short tons per day		
Chief Consolidated Mining Co.	Eureka	Flotation	200	Oxidized lead	Oxidized lead.
Combined Metals Reduction Co. (custom mill).	Bauer	do	700	Lead-zinc	Lead and zinc.
International Smelting Co.:					
Custom oxide plant.	International	do	150	Oxidized lead	Oxidized lead.
Custom sulphide plant.	do	do	1,200	Copper, lead, and lead-zinc-iron.	Copper, lead, zinc, and iron.
Park Utah Consolidated Mines Co. (Judge mill).	Park City	Gravity and flotation.	450	Lead-zinc-iron	Lead and lead-zinc-iron.
Silver King Coalition Mines Co.	do	Flotation	800	Lead-zinc	Lead and zinc.
United States Smelting, Refining & Mining Co. (custom mill).	Midvale	do	1,000	Lead-zinc-iron	Lead, zinc, and iron.
Utah-Apex Mining Co.	Bingham	do	700	Copper-lead and lead-zinc.	Copper-lead, lead, and zinc.
Utah Copper Co	Arthur	do	30,000	Copper	Copper.
Do	Magna	do	30,000	do	Do.

A circular[3] giving the flotation reagents used in 1929 and the kinds of ore treated by flotation, with the results, was issued by the Bureau of Mines in 1931. The report for 1930, giving the flotation reagents used and the kinds and grade of ore, appears as a chapter of Mineral Resources.

Concentrates produced in Utah in 1930 yielded 53 per cent of the total gold, 62 per cent of the silver, 92 per cent of the copper, 70 per cent of the lead, and nearly all the zinc. The quantity of copper concentrates, which exceeded all others, decreased 45 per cent, but the average grade of the concentrates was the same as in 1929—32 per cent. Large decreases were also recorded in the production of lead concentrates and zinc concentrates, but the quantity of dry and siliceous concentrates increased slightly. Included with the dry and siliceous concentrates was a large quantity of iron concentrates, containing gold and silver with a little copper and lead, made at custom flotation plants treating galena-sphalerite-pyrite ores.

The 19 concentrating plants running in Utah in 1930 treated 10,536,145 tons of mill ore and old tailings from Utah mines, a decrease from 1929 of 8,675,630 tons, mostly in copper ore. Crude mill ore amounted to 10,435,485 tons and old tailings to 100,660 tons. Of this total ore and old tailings, 10,471,658 tons (99.39 per cent) were treated by flotation, 62,027 tons (0.59 per cent) by combined gravity and flotation, and the remaining 2,460 tons (0.02 per cent) by gravity machines without flotation equipment. The following table gives a summary of all ore and old tailings concentrated and a separation by classes of ore. The concentrates produced have been separated by classes and by the three methods of concentration.

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[3] Miller, T. H., and Kidd, R. L., Flotation Reagents, 1929: Rept. of Investigations 3112, Bureau of Mines, 1931, 20 pp.

Utah ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates

Class of material concentrated	Method of concentration	Ore and old tailings concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore:							
Siliceous gold	Flotation	120	25.00	40			
Copper sulphide	do	9,592,530	86,528.78	858,234	187,505,854		
Copper-lead sulphide	do	20,653	918.89	58,971	635,231	2,105,218	
Lead oxidized	do	82,583	11,403.18	1,193,094	279,821	25,947,589	
Lead sulphide	do	6,359	695.87	19,035	60,974	1,389,257	
Lead-zinc sulphide	do	669,413	42,191.83	6,643,079	5,235,365	136,918,210	113,748,898
		10,371,658	141,763.55	8,772,453	193,717,245	166,360,274	113,748,898
Do	Gravity and flotation	62,027	1,014.22	329,813	150,475	13,270,919	16,941,748
Lead sulphide	Gravity	1,800	21.00	7,390	10,500	293,400	
Total ore		10,435,485	142,828.77	9,109,656	193,878,220	179,924,593	130,690,646
Old tailings:							
Lead sulphide	Gravity	660	10.00	860	1,130	30,000	
Lead-zinc sulphide	Flotation	100,000	36.00	11,200	14,300	162,000	461,000
Total old tailings		100,660	46.00	12,060	15,430	192,000	461,000
Grand total		10,536,145	142,874.77	9,121,716	193,893,650	180,116,593	131,151,646

Class of material concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
Ore:			*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Siliceous gold	Flotation	Siliceous gold	6	22.01	31			
Copper sulphide	do	Copper sulphide	261,035	65,124.00	643,543	166,904,651		
Copper-lead sulphide	do	Copper-lead sulphide	2,277	571.48	44,262	505,478	1,766,227	
Lead oxidized	do	Lead oxidized	28,819	8,317.19	1,002,448	170,069	24,167,020	
Lead sulphide	do	Lead sulphide	1,381	521.90	16,370	33,253	1,278,116	
Lead-zinc sulphide	do	do	118,193	24,218.28	5,592,475	3,494,039	123,327,732	
		Iron sulphide	64,304	7,595.14	143,768	221,946	2,002,939	
		Lead-zinc sulphide	1,127	78.88	9,157	22,799	187,086	1,210,968
		Zinc sulphide	78,339	3,329.63	435,584	825,761	4,224,087	86,299,710
			555,481	109,778.51	7,887,638	172,177,996	156,953,207	87,510,678
Do	Gravity and flotation	Lead sulphide	13,523	733.13	280,264	98,670	11,312,224	
		Iron sulphide	3,721	52.90	4,005	1,021	43,366	
		Zinc sulphide	8,756	39.61	6,180	6,129	21,683	10,069,349
Lead sulphide	Gravity	Lead sulphide	416	13.69	6,393	8,367	247,984	
Total from ore			581,897	110,617.84	8,184,480	172,292,183	168,578,464	97,580,027
Old tailings:								
Lead sulphide	Gravity	Lead sulphide	66	8.43	688	908	24,263	
Lead-zinc sulphide	Flotation	do	138	22.39	7,580	7,584	128,188	
		Zinc sulphide	289	1.58	420	1,460	5,832	317,554
Total from old tailings			493	32.40	8,688	9,952	158,283	317,554
Grand total			582,390	110,650.24	8,193,168	172,302,135	168,736,747	97,897,581

In 1930 exact figures on the contents of the mill ore in Utah were again obtained; they are presented in the accompanying tables. The original feed to the concentration mills—10,536,145 tons of ore and old tailings of all classes—contained 142,874.77 ounces of gold, 9,121,716 ounces of silver, 193,893,650 pounds of copper, 180,116,593 pounds of lead, and 131,151,646 pounds of zinc. The ore and old tailings were reduced to 582,390 tons of concentrates of all classes, an average ratio of concentration of 18.09:1. The concentrates contained 110,650.24 ounces of gold, 8,193,168 ounces of silver, 172,302,135 pounds of copper, 168,736,747 pounds of lead, and 97,897,581 pounds of zinc. The calculated recoveries in the concentrates in 1930 were as follows: Gold, 77.45 per cent; silver, 89.82 per cent; copper, 88.86 per cent; lead, 93.68 per cent; and zinc, 74.64 per cent. The corresponding calculated recoveries for 1929 were as follows: Gold, 71.69 per cent; silver, 89.36 per cent; copper, 85.74 per cent; lead, 92.75 per cent; and zinc, 74.96 per cent. A comparison of these figures indicates an improved recovery of each metal except zinc. The following table gives the metallurgic results obtained in 1930 in the treatment of Utah ores by concentration.

Metallurgic results obtained by concentration of Utah ore and old tailings in 1930

Class of material treated	Concentrates produced	Ratio of concentration	Per cent recovered in concentrates				
			Gold	Silver	Copper	Lead	Zinc
Ore by flotation:							
Siliceous gold	Siliceous gold	20.00:1	88.04	77.50			
Copper sulphide	Copper sulphide	36.75:1	75.26	74.98	89.01		
Copper-lead sulphide	Copper-lead sulphide	9.07:1	62.19	75.06	79.57	83.90	
Lead oxidized	Lead oxidized	2.87:1	72.94	84.02	60.78	93.14	
Lead sulphide	Lead sulphide	4.60:1	75.00	86.00	54.54	92.00	
Lead-zinc sulphide	do	5.66:1	57.40	84.18	66.74	90.07	
	Iron sulphide	10.41:1	18.00	2.16	4.24	1.46	
	Lead-zinc sulphide		.19	.14	.44	.14	1.07
	Zinc sulphide	8.55:1	7.89	6.56	15.77	3.09	75.87
Total lead-zinc sulphide.		2.56:1	83.48	93.04	87.19	94.76	76.94
Total ore by flotation		18.67:1	77.44	89.91	88.88	94.35	76.94
Total ore and old tailings by all methods.		18.09:1	77.45	89.82	88.86	93.68	74.64
Total, 1929		22.52:1	71.69	89.36	85.74	92.75	74.96

Gross metal content of Utah concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	68,031	7,670.05	147,804	222,967	2,046,305	
Copper	261,035	65,124.00	643,543	166,904,651		
Lead	162,536	33,835.01	6,906,218	3,812,890	160,485,527	
Zinc	87,384	3,370.82	442,184	833,350	4,251,602	96,686,613
Copper-lead	2,277	571.48	44,262	505,478	1,766,227	
Lead-zinc	1,127	78.88	9,157	22,799	187,086	1,210,968
	582,390	110,650.24	8,193,168	172,302,135	168,736,747	97,897,581
Total, 1929	853,052	166,439.30	10,454,047	311,063,374	204,157,366	113,602,098

Mine production of metals from Utah concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Ore and old tailings to concentrating mills		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	22, 190		6, 553	234. 53	204, 018	25, 500	3, 422, 060	3, 284, 062
Iron	120		6	22. 01	31			
Juab	19, 471		5, 015	591. 83	268, 069	31, 685	3, 492, 352	636, 230
Salt Lake	9, 958, 398	660	426, 448	84, 473. 27	2, 781, 784	164, 634, 505	71, 570, 692	44, 724, 792
San Juan	750		107		70	43, 223		
Summit	175, 043	100, 000	46, 150	3, 474. 50	2, 580, 781	1, 042, 409	36, 670, 376	16, 751, 521
Tooele	11, 253		2, 487	118. 45	27, 178	17, 411	1, 787, 760	715, 042
Utah	70, 153		26, 372	7, 921. 98	771, 662	111, 565	20, 776, 621	316, 209
Wasatch	178, 107		69, 252	13, 813. 67	1, 559, 575	611, 911	24, 536, 853	22, 333, 748
	10, 435, 485	100, 660	582, 390	110, 650. 24	8, 193, 168	166, 518, 209	162, 256, 714	88, 761, 604
Total, 1929	18, 961, 775	250, 000	853, 052	166, 439. 30	10, 454, 047	299, 659, 342	193, 678, 227	102, 982, 583

BY CLASSES OF CONCENTRATES

	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	68, 031	7, 670. 05	147, 804	143, 774	1, 960, 120	
Copper	261, 035	65, 124. 00	643, 543	162, 396, 675		
Lead	162, 536	33, 835. 01	6, 906, 218	2, 821, 557	154, 482, 851	
Zinc	87, 384	3, 370. 82	442, 184	729, 602	3, 944, 170	87, 652, 566
Copper-lead	2, 277	571. 48	44, 262	405, 944	1, 695, 103	
Lead-zinc	1, 127	78. 88	9, 157	20, 657	174, 470	1, 109, 038

Ore of all kinds shipped to smelters amounted to 4 per cent of the total output of ore, etc., and yielded 45 per cent of the gold, 36 per cent of the silver, 6 per cent of the copper, 29 per cent of the lead, and a small quantity of zinc. An unusually large decrease was recorded in shipments of first-class lead ore. Shipments of copper ore and siliceous ore also declined, but shipments of first-class copper-lead ore increased decidedly. After closing its mill in July, the Utah-Apex Mining Co. confined its efforts to shipping first-class ore, chiefly copper-lead ore.

Gross metal content of Utah crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Ore (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	170, 148	65, 719. 08	1, 956, 585	1, 700, 940	7, 462, 107	
Copper	103, 565	15, 804. 27	299, 139	6, 114, 908	954, 060	
Lead	145, 273	10, 781. 02	2, 333, 049	1, 205, 071	64, 183, 722	
Copper-lead	32, 099	1, 944. 36	82, 977	1, 848, 617	1, 132, 185	
Lead-zinc	432				63, 928	262, 946
	451, 517	94, 248. 73	4, 671, 750	10, 869, 536	73, 796, 002	262, 946
Total, 1929	558, 867	70, 745. 18	6, 879, 735	12, 186, 055	114, 099, 345	41, 461

Mine production of metals from Utah crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	4,508	442.48	32,067	81,384	660,380	179,292
Box Elder	131	1.94	171	24,008	5,960	
Juab	86,769	8,385.38	1,032,314	1,579,803	4,809,748	
Millard	32	2.03	65	2,938	7,760	
Piute	13	116.39	579			
Salt Lake	177,993	21,422.14	751,800	7,271,857	13,875,368	
Sevier	112				7,520	50,042
Summit	948	43.81	29,332	7,591	257,504	
Tooele	34,473	4,241.54	278,791	205,259	18,873,220	
Utah	144,064	59,514.36	2,507,455	677,943	28,577,159	
Wasatch	1,724	78.66	39,176	11,512	250,047	
Washington	750			465,223		
	451,517	94,248.73	4,671,750	10,327,518	67,324,666	229,334
Total, 1929	558,867	70,745.18	6,879,735	11,454,902	103,585,182	36,902

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	170,148	65,719.08	1,956,585	1,615,098	4,458,643	
Copper	103,565	15,804.27	299,139	5,956,696	503,700	
Lead	145,273	10,781.02	2,333,049	958,246	61,684,801	
Copper-lead	32,099	1,944.36	82,977	1,797,478	632,371	
Lead-zinc	432				45,151	229,334

The miscellaneous material consisted of 54,179 tons of old tailings, slag, mill cleanings, and matte shipped for smelting and copper from mine-water precipitates and from leaching of ore in place. This miscellaneous material yielded 3,556.06 ounces of gold, 264,503 ounces of silver, 3,680,696 pounds of copper, and 1,408,400 pounds of lead, valued in all at $724,254. Most of the gold, silver, and lead in this material came from old tailings from the Tintic district in Juab County, whereas most of the copper was recovered from precipitates from ore leached in place and from mine waters from the Bingham or West Mountain district in Salt Lake County.

REVIEW BY COUNTIES AND DISTRICTS

BEAVER COUNTY

In 1930 three lode mines in Beaver County produced 26,699 tons of ore yielding metals valued at $489,155, a decided increase from $275,224 in 1929. The marked increase in the output of ore from the Horn Silver mine at Frisco accounted for substantial increases in all five metals, especially lead and zinc.

Beaver Lake district.—The Beaver Copper Co. worked its property near Milford eight months of the year but marketed no ore. The company spent most of the year on development, consisting of 170 feet of drifting and 70 feet of sinking in a winze; 2,000 feet of road work was done. A car of oxidized copper ore was shipped from the property in 1929.

Newton district.—The old Sheep Rock mine 45 miles east of Milford was worked by a lessee for a short time in 1930. A small quantity of ore, averaging 4.21 ounces of gold and 102 ounces of silver to the ton, was shipped to the smelter at Midvale, and about 200 feet of drifting was reported.

San Francisco district.—The Tintic Lead Co. worked the Horn Silver mine at Frisco continuously and shipped 25,085 tons of ore, an increase of more than 16,000 tons over 1929. Most (21,390 tons) of the output in 1930 was lead-zinc ore shipped to the custom flotation plant of the Combined Metals Reduction Co. at Bauer and separated into lead concentrates and zinc concentrates. The remainder consisted of 1,681 tons of siliceous gold ore, 1,305 tons of first-class lead ore, and 709 tons of first-class copper ore, all of smelting grade. The mine is opened by a 1,600-foot vertical shaft and by several miles of drifts and crosscuts; 3,397 feet of drifting and crosscutting was done in 1930. The chief commercial minerals contained in the ore are galena, sphalerite, pyrite, chalcopyrite, and anglesite. According to a report made to the industrial commission the mine produced 25,085 tons of ore containing 843 ounces of gold, 267,790 ounces of silver, 128,139 pounds of copper, 4,406,457 pounds of lead, and 4,090,474 pounds of zinc. The gross proceeds were $158,631; after $160,876 was deducted for extraction, transportation, reduction, and construction the net loss was $2,245. In 1929 the gross proceeds from 230 ounces of gold, 67,475 ounces of silver, 36,167 pounds of copper, 1,722,425 pounds of lead, and 2,083,609 pounds of zinc were $88,043. The property ranked fourth in the production of zinc in Utah in 1930, tenth in lead, and fifteenth in silver. Further details of operations were not made public, as the company issued no annual report for 1930. The Frisco Lulu group adjoining the Horn Silver mine was worked under lease and option by the American Smelting & Refining Co. during 1930, and 1,500 feet of drifting was done after the new surface plant was completed. This work, however, failed to open commercial ore, and the company suspended operations in December. The Frisco Silver-Lead Mining Co. worked its property throughout the year and reported the opening of considerable low-grade silver-lead ore. Low metal prices, however, prevented shipments.

Star and North Star district.—The Moscow Silver Mines Co., the only active company in the Star district in 1930, operated its mine the entire year, but the output of ore was only about one-third that in 1929; more than 600 tons of oxidized and sulphide ore was shipped for smelting. The mine is opened by a 1,600-foot vertical shaft, 25,912 feet of drifts, 1,433 feet of winzes, and 7,927 feet of raises; development in 1930 consisted of 2,220 feet of drifting, 185 feet of raising, and 28 feet of work in the winzes.

BOX ELDER COUNTY

Lucin district.—The Copper Mountain mine, owned by the Salt Lake Copper Co., was operated by lessees who shipped four cars of oxidized copper ore of smelting grade containing 1 ounce of gold, 39 ounces of silver, and 24,577 pounds of copper; the mine has been worked by lessees since 1922. The property is close to the State line between Utah and Nevada, and ore is hauled to Tuttle, Nev., a loading station on the Southern Pacific Railroad. The Tecoma property was operated under lease by the Unetah Mining Co., and two cars of iron ore were shipped to a paint company in California. In 1922 the property was a fairly large producer of zinc.

Park Valley district.—The Century Consolidated Gold Mining Co. was organized in 1930 to operate the old Century and Susannah groups, 22 miles northwest of Kelton, formerly important producers of gold. A new surface plant was constructed; and, during the latter part of the year, about 2,000 feet of tunnel work was done, chiefly in reopening the old workings. No ore, however, was shipped or treated.

CACHE COUNTY

No ore has been marketed from mines in Cache County since 1926. The Emmett Mining & Milling Co. did 65 feet of drifting on the 285-foot level of its mine near Richmond in 1930 and blocked out a little lead ore. A little development was also reported by the Richmond Mining Co.

GRAND COUNTY

No placer gold was marketed from the banks of the Colorado River in Grand County in 1930, although work near Dewey resulted in a clean-up in 1929.

IRON COUNTY

Stateline district (Gold Springs).—The Gold Coin Mining Co. operated the Gold Coin mine 18 miles north of Modena and did 350 feet of drifting. The property is equipped with a 50-ton flotation plant, and in 1930 a small quantity of gold ore was treated experimentally; the resulting concentrates were shipped to Garfield for smelting.

JUAB COUNTY

Twenty-one lode mines, three old tailings dumps, and one slag dump in Juab County produced metals valued at $1,646,258 in 1930, an amount smaller than any annual valuation of the past 10 years and a decided decrease from $3,219,476 in 1929. Most of the ore, old tailings, etc., came from mines and dumps near Eureka, mentioned in the review of the Tintic district. The unusual drop in metal prices resulted in a marked curtailment at most of the large producing mines.

Detroit district.—Several cars of oxidized copper ore containing gold and silver were shipped by a lessee from the Ibex dump 18 miles northwest of Sugarville.

Fish Springs district.—The Utah mine near Callao was worked by lessees who shipped two cars of silver-lead ore of smelting grade after hauling it to Gold Hill, a station on the Deep Creek Railroad.

Gilson Mountain district.—The Arrowhead Metal Mining Co. worked its property 4 miles north of Leamington and did 338 feet of work in an inclined shaft and tunnel. No ore, however, was shipped or treated in 1930.

Mount Nebo district.—The Bishop property 7 miles south of Santaquin was worked by a lessee who shipped one car of first-class oxidized lead ore to the smelter at Murray. A small quantity of similar ore was shipped from the Hammond property near Santaquin.

Tintic district.—The production from the old mines near Eureka in the western part of the Tintic district in Juab County and from the comparatively new mines in the eastern section of the Tintic district in Utah County was much less than that in 1929. The mines in both sections of the Tintic district are reviewed here, and their output is included in the following table.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Utah, 1929 and 1930, and total, 1869–1930, in terms of recovered metals

	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
1930		*Short tons*		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Juab County	16	159, 543	$257, 554	1, 557, 047	2, 080, 831	9, 625, 240	636, 230	$1, 639, 326
Utah County	10	213, 925	1, 391, 587	3, 277, 782	780, 869	49, 322, 760	316, 209	5, 236, 362
	26	[1] 373, 468	1, 649, 141	4, 834, 829	2, 861, 700	58, 948, 000	952, 439	6, 875, 688
Total, 1929	34	[2] 455, 316	1, 017, 293	6, 272, 456	3, 166, 159	88, 226, 699	1, 051, 045	10, 545, 407
Total, 1869-1930		(3)	41, 979, 573	222, 197, 094	216, 411, 477	1, 602, 624, 739	30, 987, 812	332, 006, 981

[1] Includes 52,740 tons of old tailings and 867 tons of old slag sold to a smelter.
[2] Includes 59,423 tons of old tailings and 108 tons of old slag sold to a smelter.
[3] Figures not available.

NOTE.—Total dividends, 1869-1930, $53,969,285.

The value of the metals from the Tintic district in 1930 was as follows: Gold, $1,649,141, compared with $1,017,293 in 1929; silver, $1,861,409, compared with $3,343,219; copper, $372,021, compared with $557,244; lead, $2,947,400, compared with $5,558,282; and zinc, $45,717, compared with $69,369. The ore, old tailings, etc., sold or treated in the district in 1930 yielded on an average $18.41 in metals a ton, compared with $23.16 in 1929.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Utah, in 1930, by classes of ore, in terms of recovered metals

Class of ore	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	19	[1] 215, 771	67, 099. 45	2, 120, 175	2, 019, 027	5, 610, 757	
Copper	5	[2] 4, 679	482. 09	55, 168	417, 212	66, 531	
Lead	16	145, 918	11, 992. 56	2, 621, 583	417, 386	52, 269, 395	
Copper-lead	1	17	. 74	267	815	3, 101	
Lead-zinc	3	7, 083	202. 35	37, 636	7, 260	998, 216	952, 439
	[3] 26	373, 468	79, 777. 19	4, 834, 829	2, 861, 700	58, 948, 000	952, 439

[1] Includes 52,740 tons of old tailings sold to a smelter.
[2] Includes 867 tons of old slag sold to a smelter.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

The output of metals in 1930 from the Chief Consolidated properties—the Chief No. 1, Grand Central, Eureka Hill, and Tintic Bullion mines—was less than half that in 1929. The total shipments of ore from these mines, including 9,968 tons of mill ore, were reported as 26,052 tons in 1930, compared with 48,643 tons in 1929.

The output of the Chief or No. 1 mine is given for 1930 separately—10,914 tons of ore containing 518 ounces of gold, 127,106 ounces of silver, 8,966 pounds of copper, 1,615,988 pounds of lead, and 905,543 pounds of zinc. The company received $66,557 from the sale of the ore, and after various charges were deducted the net loss was $67,019. Of the 10,914 tons of ore, 295 tons of silver-lead ore and 1,647 tons of dry and siliceous ore were shipped for smelting; the custom flotation plant at Midvale received 4,658 tons of lead-zinc ore; and the concentrator at the Chief mine received 4,314 tons, of which 3,428 tons represented silver-lead ore and 886 tons dry and siliceous ore. These ores averaged as follows: Gold, $0.97; silver, 11.646 ounces; lead in lead ores, 14.60 per cent; copper in copper ores, 0.37 per cent; lead in lead-zinc ores, 5.68 per cent; and zinc in zinc-lead ores, 9.72 per cent. All ores averaged $18.58 a ton in total value; and after $12.97 was deducted for smelting, freight, and sampling the net value was $5.61 a ton. More than 200 feet of development was done in the Chief No. 1 mine in 1930, chiefly in drifting.

The output of the Chief mine from 1909, the year of discovery, to 1930 was as follows: 1,231,169 tons of ore, 81,133 ounces of gold, 31,957,241 ounces of silver, 473,858 pounds of copper, 206,492,731 pounds of lead, 22,953,944 pounds of zinc, and 1,470,188 pounds of manganese, for which the smelters paid $24,848,762; after various charges were deducted the net profit was $5,819,535. The Grand Central or No. 5 mine in 1930 produced 9,084 tons of ore, 1,047 ounces of gold, 80,388 ounces of silver, 320,237 pounds of copper, and 349,236 pounds of lead. The ore sold for $57,063, and after various charges were deducted the net profit was $3,778. Of the 9,084 tons of ore, 7,646 tons of dry and siliceous ore and 809 tons of silver-lead ore were shipped for smelting; and the concentrator at the Chief mine received 629 tons, of which 213 tons represented silver-lead ore and 416 tons dry and siliceous ore. These ores averaged as follows: Gold, $2.38; silver, 8.85 ounces; copper in copper ores, 2.06 per cent; and lead in lead ores, 17.08 per cent. All ores averaged $13.86 a ton in total value; and after $7.58 was deducted for smelting, freight, and sampling the net value was $6.28 a ton. About 393 feet of development was done in the Grand Central mine in 1930, chiefly in drifting. Since the property was acquired by the Chief Consolidated Mining Co. in 1922 the Grand Central has produced 219,935 tons of ore, 55,114 ounces of gold, 3,114,013 ounces of silver, 6,699,535 pounds of copper, and 9,260,568 pounds of lead, for which the smelters paid $2,732,911; after various charges were deducted the net profit was $298,517. The report of the Chief Consolidated Mining Co. says:

> Your company has had the following mines in operation during the past year: No. 1, Plutus, Eureka Lilly, Grand Central, and Eureka Hill. In addition to these it has given over on short term leases the following properties owned or controlled by your company: Eureka Bullion Mining Co., part of Eureka Lilly Mining Co., part of East Tintic Consolidated Mining Co., Baltimore property (wholly owned by your company), and Tintic Bullion property (wholly owned by your company). This means that your company has now under direct operation or by lease 10 distinct properties. There has been produced during the year from these several properties 80,319 tons of ore, and this product would have greatly diminished our losses had it not been for the depreciation in the prices of the metals.
>
> The amount of development work in the Plutus and Eureka Lilly properties was near that of the previous year and led to discoveries of a number of new ore bodies which under normal market conditions would have shown some profit.
>
> In order to accentuate the development of your company's territory there have been given out six leases to different mining companies which call for a definite amount of development work each month on these tracts, the cost of which is not shared by your company unless ore is discovered, and then your company gets a share of the profits that may accrue. This work is beginning to show results as gold ore has been discovered on the south end of the Eureka Lilly; small amounts but not of shipping value of lead ore were discovered on the East Tintic Consolidated, and in addition to this we are quite sure that gold ore from a neighboring property will pitch into this property; also, some lead-zinc ore has been discovered on the Tintic Bullion tract which to date has not yet been sufficiently developed to determine its size but is considered a reliable indicator of the presence of a new channel in that area. In the short time that these leases have been operating we consider the results obtained so far have been gratifying.

> * * * One noteworthy development during the past year in the eastern side of the district has been a very decided increase in the gold content of the ore; this gives some hope that this metal may ultimately be developed in much larger quantity than heretofore.

The Plutus mine, controlled and operated by the Chief Consolidated Mining Co., produced 21,907 tons of oxidized silver-lead ore containing 1,100 ounces of gold, 612,022 ounces of silver, 179,287 pounds of copper, and 2,238,709 pounds of lead. The output of gold and copper increased over that in 1929; but the output of silver and lead, especially lead, decreased. Of the 21,907 tons of ore, 1,713 tons of dry and siliceous ore and 10,685 tons of silver-lead ore were shipped for smelting; and the concentrator at the Chief mine received 9,509 tons, of which 4,854 tons represented silver-lead ore and 4,655 tons dry and siliceous ore. These ores averaged as follows: Gold, $1.03; silver, 27.94 ounces; lead in lead ores, 17.05 per cent; and copper in copper ores, 0.75 per cent. All ores averaged $22.03 a ton in total value; and after $12.04 was deducted for smelting, freight, and sampling, the net value was $9.99 a ton. About 5,678 feet of development was done in the Plutus mine in 1930, chiefly in drifts. The Chief Consolidated Mining Co. received $218,815 from the sale of ore from the Plutus mine, and after various expenses were deducted the net loss was $6,660. Since the controlling interest in the mine was acquired by the Chief Consolidated Mining Co. in 1923, the property has produced 172,919 tons of ore, 7,006 ounces of gold, 4,853,060 ounces of silver, 1,314,828 pounds of copper, and 39,431,514 pounds of lead, for which the smelters paid $3,463,972; after various charges were deducted the net profit was $1,033,532.

The Chief Consolidated Mining Co. received $782,210 from the sale of ore, concentrates, lime, etc., from its various properties; the costs were $791,616; and the net operating loss was $9,406. Miscellaneous expenditures, including interest on bonds, taxes, etc., amounted to $62,374; after $1,879 was credited for miscellaneous income the total net loss for the year was $69,901. The net surplus on December 31, 1930, was $3,349,441.

The Chief Consolidated flotation plant at Eureka treated nearly 35,000 tons of ore in 1930, more than half of which came from the Eureka Lilly mine at Dividend; most of the remainder came from the Plutus and Chief No. 1 mines. The methods used at the plant are fully described in a circular [4] published in July, 1930.

The Eagle & Blue Bell mine was worked continuously by the United States Smelting, Refining & Mining Co. until April 25, when the property was closed. According to the report to the industrial commission the mine produced 901 tons of oxidized lead ore of smelting grade containing 81 ounces of gold, 2,795 ounces of silver, 2,406 pounds of copper, and 178,868 pounds of lead, valued in all at $8,868. The output of ore decreased decidedly from 4,256 tons in 1929, and the production of metals was proportionately less.

The Victoria property adjoining the Eagle & Blue Bell mine was also worked by the United States Smelting, Refining & Mining Co. until April 25, when it was closed. The output of ore decreased from 18,288 tons in 1929 to 12,210 tons in 1930, and the production of silver and lead was less than half that in 1929; there was, however, an increase in the production of gold. According to the report to the industrial commission the company shipped to the smelters 12,210 tons of first-class ore containing 1,275 ounces of gold, 146,733 ounces of silver, 333,936 pounds of copper, and 1,238,213 pounds of lead, valued in all at $138,559. After various charges, including cost of extraction and freight and smelter charges, were deducted the net profit was $7,733. About half the output was siliceous gold and silver ore shipped from the dump, and the remainder was chiefly oxidized lead ore. Development in 1930 consisted of 253 feet of drifting and 13 feet of raising.

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[4] Wigton, G. H., Milling Methods and Costs at the Concentrator of the Chief Consolidated Mining Co., Eureka, Utah: Inf. Circ. 6320, Bureau of Mines, 1930, 18 pp.

The Mammoth Mining Co. continued to operate its property near Mammoth south of Eureka and shipped 27,398 tons of siliceous gold and silver ore and oxidized silver-lead ore of smelting grade, a decrease of 1,592 tons from the output in 1929. Most of the output was siliceous gold and silver ore containing lead and copper. The report to the industrial commission gave 27,398 tons of ore containing 3,326 ounces of gold, 242,177 ounces of silver, 309,482 pounds of copper, and 601,394 pounds of lead. The gross yield was $227,552; and after various charges, including cost of extraction and freight and smelter charges, were deducted the net loss was $3,247. The output of gold in 1930 was nearly double that in 1929; but the output of silver and lead was only about half that in 1929, and the output of copper decreased slightly. The mine is developed by a 2,100-foot vertical shaft and by several miles of drifts and tunnels; about 1,500 feet of work was done in 1930, chiefly in drifting.

The American Smelting & Refining Co. shipped several thousand tons of old tailings as well as some old slag from the Mammoth dump, but the quantity shipped in 1930 was less than that in 1929. The material contains gold, silver, copper, and lead but is chiefly valuable for its gold and silver; it is used as a siliceous flux at the copper smelter at Garfield. About 315,000 tons of this material have been shipped since 1925.

Old tailings were also shipped from the Eureka Hill dump owned by the Chief Consolidated Mining Co. The company shipped more than 43,000 tons in 1930, or more than double the quantity shipped in 1929. The material contained $1.29 in gold and 5.17 ounces of silver to the ton, 0.31 per cent of copper, and 2.55 per cent of lead; it was all shipped to the smelter at Garfield.

The Iron Blossom mine near Silver City, owned by the Tintic Standard Mining Co., produced 1,550 tons of oxidized lead ore and siliceous ore of smelting grade, a decided decrease from 4,160 tons produced in 1929. The production is included in the statement of the Tintic Standard Mining Co. (See p. 582) The property is extensively developed; in 1930 more than 4,700 feet of work, chiefly in drifting, was done before May 31, when the mine was closed.

The Bullion Beck & Champion property, controlled by the United States Smelting, Refining & Mining Co., was operated on company account until April 30. From May 1 to September the property was operated by lessees, after which it was permanently closed. According to a report to the industrial commission the company shipped from the Bullion Beck & Champion property 5,188 tons of ore and old tailings containing 215 ounces of gold, 39,880 ounces of silver, 28,813 pounds of copper, and 401,393 pounds of lead. This output represents a large decrease from that in 1929, when shipments amounted to 19,346 tons of ore and old tailings containing 438 ounces of gold, 118,886 ounces of silver, 96,671 pounds of copper, and 1,721,468 pounds of lead. Development in 1930 consisted of 225 feet of work on the 600, 700, and 800 foot levels.

The Centennial Eureka property, owned by the United States Smelting, Refining & Mining Co., was operated by lessees who, according to a report to the industrial commission, shipped 6,868 tons of ore containing 909 ounces of gold, 31,522 ounces of silver, 93,380 pounds of copper, and 70,341 pounds of lead. Nearly all the material was low-grade siliceous ore from waste dumps, and the metal production was decidedly less than that in 1929.

The Gold Chain Mining Co. did no work on the Gold Chain mine in 1930; but lessees shipped 647 tons of first-class oxidized copper ore of smelting grade containing 80 ounces of gold, 3,973 ounces of silver, and 69,495 pounds of copper. The property has been in the hands of lessees since 1924.

The United Sunbeam mine near Silver City was worked nine months by lessees who shipped nearly 400 tons of sulphide copper ore to the smelter at Garfield; a little first-class lead ore and copper-lead ore were also shipped for smelting.

Other properties in the Juab County part of the Tintic district, from which ore was shipped by lessees, were the Empire, Dragon, Swansea, Windrige (Undine), and Wahomie. The Tintic Drain Tunnel Co. did no work at its property in 1930, but several cars of iron-manganese ore were shipped by lessees to the Columbia Steel Co. plant near Provo. The North Beck Co. mined no ore in 1930, but development consisted of 326 feet of drifting and 800 feet of diamond drilling. The property is developed by three shafts; one is 400 feet deep, and two are each 1,600 feet deep. At the Emerald property near Mammoth 800 feet of drifting and 65 feet of raising were done during the year. Considerable development was also done at the South Standard mine by the Little May Mining Co.

The chief producers in the eastern part of the Tintic district in Utah County were the Tintic Standard, North Lily, Eureka Standard, and Eureka Lilly properties.

The North Lily mine was worked continuously in 1930, but on a 1-shift basis after July 1. The output of ore and the production of all metals except gold decreased considerably; the largest decrease was in the output of lead, which declined more than 17,000,000 pounds. An interesting feature in 1930 was the opening of a large body of siliceous gold ore, similar to the ore of the Eureka Standard mine; as a result of this find, the production of gold increased more than 12,000 ounces. Of the 58,384 wet tons of ore mined in 1930, 36,624 tons were oxidized silver-lead ore from the upper levels of the mine shipped to the lead smelter and to the new oxide flotation plant at International, 19,050 tons were first-class siliceous gold ore, and the remaining 2,781 tons were sulphide lead-zinc ore shipped to the International sulphide concentration plant. The ore is delivered from the shaft to the railway siding by an aerial tramway 2,896 feet long. Development work aggregating 16,441 feet was done, chiefly in drifts and crosscuts. The chief ore mineral has been anglesite with some galena; but in 1930 considerable siliceous gold ore was mined and the production of gold was more than doubled although the output of ore was considerably decreased. According to the printed annual report of the North Lily Mining Co. for the year ended December 31, 1930, the mine produced 55,717 dry tons of ore containing 21,943.55 ounces of gold, 439,443 ounces of silver, 15,843,836 pounds of lead, and 357,673 pounds of zinc, which sold for $832,348, compared with $1,647,108 in 1929. After mine operating expenses ($558,621), freight on ore shipments ($69,483), and other miscellaneous expenses were deducted an operating profit of $193,843 remained. Income from other sources amounted to $15,861, which made a total income of $209,704; after $48,920 was deducted for depreciation and reserve for Federal taxes the net income was $160,784. On December 31 the surplus was $1,241,667. The mine ranked third in the production of gold in Utah in 1930, sixth in lead, and ninth in silver. Dividends of $119,333 were paid in 1930, making a total of $1,073,993 since the first dividend was paid in September, 1928. The following paragraphs are taken from the company's annual report.

> Operations at the North Lily mine were carried on continuously during the year 1930.
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> * * * The high-grade and low-grade lead ores came from the old workings of the main ore body. The lead-zinc ore was mined from the 1,000 and 1,100 area and was discontinued during the last half of the year on account of low metal prices.
>
> The major ore development of the year was the discovery of gold ore in the fissure zone in the quartzite underlying the main ore body. The development of this gold ore enabled the mine to operate at a profit in a year in which low prices for lead, zinc, and silver prevailed.
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> Long range exploration, despite the extensive prospecting program maintained throughout the year, has lessened the prospects for finding new ore bodies within our own boundaries.
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> In an effort to secure greater efficiency and lower cost, the North Lily was operated only on day shift after July 1.
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> Operating cost per ton of ore including fillings, taxes, and depreciation of equipment was $10.2693.

According to the printed annual report of the Tintic Standard Mining Co. for the year ended December 31, 1930, the Tintic Standard and Iron Blossom mines produced 60,316 dry tons of lead ore and 35,857 dry tons of siliceous ore. These ores contained 3,853.32 ounces of gold, 2,511,819 ounces of silver, 30,953,096 pounds of lead, and 643,663 pounds of copper, which sold for $2,790,680, compared with $4,265,337 in 1929. The output of metals in 1930, especially silver and lead, decreased considerably from that in 1929. After smelter and freight charges of $1,354,101 were deducted the net smelter returns amounted to $1,436,579. Income from other sources amounted to $315,078, which made a total income for the year of $1,751,657. After $1,194,701 was deducted for all expenses, including $835,396 for mine operation, $153,840 for State, county, and Federal taxes, and $104,992 for general administration, there remained a net income carried to surplus account of $556,956. On December 31 the total current assets of the company were $2,707,760. Dividends of $1,268,647 were paid in 1930, making a total of $13,825,231 since the initial dividend was paid in June, 1917. The Tintic Standard Mining Co. was the largest producer of silver in Utah in 1930; it ranked third in production of lead, ninth in copper, and twelfth in gold. The lead ore from the Tintic Standard mine at Dividend contained on the average 0.035 ounce of gold and 29.15 ounces of silver to the ton, 0.304 per cent of copper, and 23.13 per cent of lead. The siliceous ore contained on the average 0.047 ounce of gold and 21.70 ounces of silver to the ton, 0.36 per cent of copper, and 4.47 per cent of lead. The Iron Blossom mine near Knightsville produced 1,550 tons of lead ore and siliceous ore. The lead ore contained on the average 0.078 ounce of gold and 8.412 ounces of silver to the ton, 0.146 per cent of copper, and 16.92 per cent of lead. The siliceous ore contained on the average 0.08 ounce of gold and 14.354 ounces of silver to the ton, 3.095 per cent of copper, and 3.733 per cent of lead. Development in 1930 at the Tintic Standard mine consisted of 7,949 feet of drifting, 967 feet of raising, and 12 feet of sinking; 1,850 feet of churn drilling was also done. The company's report gives no details regarding ore reserves; it gives the output of the Tintic Standard mine to the end of 1930—the ore shipped or milled with metal content—as follows: 1,423,411 tons of ore, 51,423.93 ounces of gold, 37,534,329 ounces of silver, 10,797,362 pounds of copper, and 392,087,637 pounds of lead. It also gives the output of the Iron Blossom mine to the end of 1930 as follows: 600,261 tons of ore, 95,715.85 ounces of gold, 15,580,463 ounces of silver, 7,416,282 pounds of copper, and 67,373,448 pounds of lead. The report continues:

> During the year 1930 there was a marked decline in the gross and in the net earnings of the company. This is entirely due to the extreme decline in metal prices. * * *
>
> Due to the low price of silver it became unprofitable to mine siliceous silver ores low in lead. The elimination of the tonnage of this class of ores reduced the total mine output to 96,172.87 tons. Lead-silver ores were affected, but not to the extent of ores whose value was principally in silver. The siliceous silver ore shipped came from operations that were producing principally lead ores. The output of lead was 30,953,095.78 pounds, which was sold for $1,709,552.55. * * *
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> * * * Development work was energetically carried on during the year; and men released from production were, in so far as practical, employed on development work. This resulted in but slight reduction in the number of the company's employees. New ore bodies of importance have been disclosed in the limestone areas on the 1,350 level. Development work in the quartzite on the 1,450 level has disclosed important copper-gold bearing fissures on which development work will be carried on. The noteworthy increase in the output of gold for the combined properties is called to your attention. Gold output in 1929 was 19,990.505 ounces. In 1930 the output was 34,395.69 ounces, an increase of 72.06 per cent. * * *

A comprehensive report[5] published in October, 1930, gives interesting notes on the history of the Tintic district, a summary of its geology, and data on the mining methods and costs at the Tintic Standard mine.

An interesting feature in Utah in 1930 was the decided increase in the output of siliceous gold ore from the Eureka Standard mine in the eastern part of the Tintic district, Utah County; the mine is controlled by the Tintic Standard Mining Co. The output increased from 18,363 tons of ore in 1929 to 28,459 tons in 1930 and from 14,755.425 ounces of gold to 30,540.37 ounces. Besides the gold the ore contained 295,169 ounces of silver, 208,737 pounds of copper, and 567,950 pounds of lead. The gross proceeds from all metals were $793,412, and after smelter and freight charges of $201,987 were deducted the net smelter returns amounted to $591,425. Other income, amounting to $1,738, made a total income of $593,163. After $296,072 was deducted for miscellaneous expenses, including $12,612 for taxes, there remained a net profit carried to surplus account of $297,091. The Eureka Standard Consolidated Mining Co. paid its initial dividend of $44,987.70 in September and another of the same amount in December, making a total of $89,975.40 for the year. The mine ranked second as a producer of gold in Utah in 1930 and eleventh in production of silver. From June, 1928, to the end of 1930 the mine produced 51,118 tons of ore containing 48,580.55 ounces of gold, 533,707 ounces of silver, 290,886 pounds of copper, and 809,862 pounds of lead. In 1930 development consisted of sinking the main vertical shaft 84 feet, sinking in winze 141 feet, drifting 3,117 feet, and raising 1,930 feet. The following paragraphs are taken from the report of the Tintic Standard Mining Co. for 1930.

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[5] Wade, J. W., Mining Methods and Costs at the Tintic Standard Mine, Tintic District, Utah: Inf. Circ. 6360, Bureau of Mines, 1930, 21 pp.

> The operations at the Eureka Standard mine have become of increasing importance.
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> * * * During the year 1930 this company increased its output of ores, its profits, and its ore reserves. An expanding program of development work has been carried on. The main shaft has been sunk to a depth of 1,427 feet where a new level will be driven to the vein. In the course of the sinking of the main shaft, hot water, with a temperature of 135° F., was encountered at a depth of 1,340 feet, and a pumping plant has been installed. The year 1930 was a prosperous year for this company as its principal revenue comes from the sale of gold. * * *

The Eureka Lilly Mining Co., controlled by the Chief Consolidated Mining Co., produced 32,181 dry tons of ore containing 13,743 ounces of gold, 143,943 ounces of silver, 24,536 pounds of copper, and 5,706,922 pounds of lead. The net smelter returns were $268,867, and after various charges were deducted the net profit was $16,897. Of the 32,181 tons of ore, 339 tons of oxidized silver-lead ore and 11,916 tons of siliceous gold ore were shipped for smelting, and 7,293 tons of oxidized silver-lead ore and 12,633 tons of dry and siliceous ore were treated in the Chief Consolidated flotation mill. The output represents a decided increase from 18,139 tons in 1929 containing 6,990 ounces of gold, 79,788 ounces of silver, and 3,994,997 pounds of lead. The net smelter returns in 1929 were $195,094. The mine ranked sixth as a producer of gold in Utah in 1930 and eighth in production of lead. About 5,975 feet of development was done in 1930, chiefly in drifting. No printed report for the Eureka Lilly mine was issued for 1930, but the report of the Chief Consolidated Mining Co. contains notes on the Eureka Lilly mine. The output from 1927 to the end of 1930 is given as 79,797 tons of ore containing 30,926 ounces of gold, 463,307 ounces of silver, 24,536 pounds of copper, and 15,547,932 pounds of lead.

The Tintic Bullion property, directly west of the North Lily mine, was worked by the Chief Consolidated Mining Co., but the metal production was considerably less than that in 1929. According to the printed annual report of the company the Tintic Bullion mine produced 208 tons of ore, of which 114 tons were sulphide lead-zinc ore shipped to Midvale for milling and 94 tons were silver-lead ore treated in the Chief Consolidated flotation mill at Eureka. These ores contained 6 ounces of gold, 681 ounces of silver, 41,312 pounds of lead, and 51,643 pounds of zinc. The ores averaged $26.88 a ton in total value; after $20.30 was deducted for smelting, freight, and sampling a net value of $6.58 a ton remained.

The Colorado Consolidated property, controlled by the Tintic Standard Mining Co., was operated by lessees who shipped 216 tons of siliceous silver ore. The Tintic Standard Mining Co. developed the property until May 30, when it was closed; the company did 252 feet of drifting, 92 feet of raising, and 109 feet of sinking.

The Iron King mine southwest of Dividend was also operated by the Tintic Standard Mining Co., chiefly on development consisting of 1,761 feet of drifting and 327 feet of raising. No nonferrous ore was shipped during the year, but 1,143 long tons of iron ore were shipped to the Columbia Steel Co. plant near Provo.

The Eureka Bullion property, controlled and operated by the Chief Consolidated Mining Co., produced much less ore in 1930 than in 1929. According to the printed annual report of the Chief Consolidated Mining Co., shipments totaled 179 tons of ore containing 39 ounces of gold, 5,793 ounces of silver, and 2,932 pounds of copper. The ore averaged $20.85 a ton in total value; after $8.03 was deducted for smelting, freight, and sampling a net value of $12.82 a ton remained.

The May Day, Utah Consolidated, and Yankee Consolidated properties were worked by lessees during the year, but the output of ore and the production of metals decreased decidedly from 1929. Most of the output in 1930 was low-grade siliceous gold and silver ore, containing copper and lead, from the old stopes. No old tailings were shipped in 1930 from the mill dump of the Tintic Standard Mining Co. at Harold; more than 25,000 tons of this material, containing chiefly silver and lead, were shipped in 1929 to the smelter at Garfield for use as flux. No ore was mined from the property of the Big Hill Mining Co in 1930, but lessees did considerable work in sinking the vertical shaft 822 feet to the 1,500-foot level. The Central Standard Consolidated Mines Co. did 1,400 feet of drifting at its property near Homansville. Considerable development work was also done in 1930 at the Crown Point Consolidated, North Standard, and East Standard properties.

MILLARD COUNTY

Cricket Mountain district.—A small quantity of sulphide lead ore of smelting grade was shipped from the Rock Hammer mine southwest of Clear Lake, and a small lot of similar ore was shipped from the Galena group.

Detroit (*Drum*) *district.*—The Copperhead mine in the Drum Mountains near the line between Millard and Juab Counties was operated a short time, and one car of oxidized copper ore containing a little gold and silver was shipped to the smelter at Garfield. The property was operated in 1904 by the Oasis Gold & Copper Mining Co., and a little ore assaying $19.20 in gold and 10 ounces of silver to the ton and 4.3 per cent of copper was marketed.

PIUTE COUNTY

The value of the production of metals in Piute County decreased from $25,815 in 1929 to $2,629 in 1930 as the Deer Trail mine near Marysvale was idle. The property was a large producer of gold in 1928 and 1929 and from 1917 to 1926, particularly from 1920 to 1922; a total of $177,745 was paid in dividends in 1921 and 1922.

Gold Mountain district.—The Annie Laurie Consolidated Gold Mines worked its property near Sevier and shipped 10 tons of first-class smelting ore containing 105.5 ounces of gold and 574 ounces of silver. Work in 1930 consisted chiefly of reconditioning the old workings of the property and testing the ore.

Mount Baldy district.—The Deer Trail mine, a fairly large producer of gold in 1929, was idle in 1930.

Ohio district.—The Gold Strike group near Marysvale, owned by the Four Metals Mining Corporation, was worked by lessees who shipped a small lot of first-class gold ore to the smelter at Midvale.

SALT LAKE COUNTY

Salt Lake County, chiefly the Bingham district, has been the most important mining center of Utah since 1905. The value of the metal output of the county in 1930 was $32,731,343, a marked decrease from $69,858,853 in 1929. The unusual drop in metal prices, particularly in copper and silver, in 1930 resulted in a decided decrease in the value of each of the five metals. The decrease in the value of the copper output alone was more than $32,000,000.

The mines of Bingham have been large producers since the early days of mining. Their output increased decidedly after the Utah Copper Co. started steam-shovel mining in 1907; but the drop in the price of copper in 1930 caused the Utah Copper Co. to curtail its output of copper about 50 per cent, and as a result the value of the county's metal output in 1930 was less than that in any year since 1922.

Big and Little Cottonwood districts.—The production of the mines at Alta, the head of Little Cottonwood Canyon, and of those in Big Cottonwood Canyon has been combined in the following table.

Mine production of gold, silver, copper, lead, and zinc in Big Cottonwood and Little Cottonwood mining districts, Utah, 1929 and 1930, and total, 1867–1930, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	7	1,814	$687	30,212	57,989	346,381	87,213	$54,574
1930	7	1,491	1,264	15,779	25,646	250,180		23,182
Total, 1867–1930		606,369	568,202	16,436,689	15,830,833	231,717,745	771,204	33,326,227

Mining in the Big Cottonwood district in 1930 was limited, and the output of ore was less than that in any year since 1910. Three lode mines produced 802 tons of ore yielding $95 in gold, 4,236 ounces of silver, 4,731 pounds of copper, and 97,460 pounds of lead, valued in all at $7,214, or $9 in metals a ton. Most of the output was lead ore from the Cardiff dump treated by jig and table concentration. A lessee constructed a crude concentration plant, treated low-grade dump ore, and shipped several cars of lead concentrates. The Alta Tunnel & Transportation Co. continued to operate the Prince of Wales property under lease and treated a little lead ore in its 50-ton concentration mill equipped with jigs and tables; one car of silver-lead concentrates was shipped to Murray for smelting. Development in 1930 consisted of 500 feet of drifting and raising. A test lot of ore containing gold, silver, and copper was produced from the Lake Blanche prospect. The Tar Baby and Kennebec properties were operated under lease by the Howell Mining Co., but no ore was mined or shipped. The properties were worked most of the year; 835 feet of development was done, chiefly in tunneling. The Bullion Chief Mining Co. was organized to operate the Maxfield mine, and the new company did considerable development in raising and drifting during the latter half of the year. A 45-ton gravity-concentration plant was erected in the mine about 1,000 feet from the portal of the adit and operated one week, but no products were shipped. The American Metal Mining Co., Big Cottonwood Bonanza Mining Co., Union Associated Mines Co., Golden Porphyry Mines Co., and Kentucky-Utah Mining Co. also developed their properties in 1930; no ore was mined or shipped.

In the Little Cottonwood district four lode mines produced 689 tons of ore yielding $1,169 in gold, 11,543 ounces of silver, 20,915 pounds of copper, and 152,720 pounds of lead, valued in all at $15,968, or $23.18 in metals a ton. Most of the output was first-class lead ore of smelting grade and copper-lead ore of milling grade from the property of the Mineral Veins Coalition Mines Co. The Jacobs Engineering & Development Co. operated several properties, including part of the holdings of the Mineral Veins Coalition Mines Co. under lease. A small mill was constructed, and a little ore was treated in 1930. The lease, however, was relinquished later in the year. According to a report to the industrial commission the Mineral Veins Coalition Mines Co. shipped 304 tons of ore and concentrates containing 34 ounces of gold, 6,136 ounces of silver, 14,307 pounds of copper, and 98,306 pounds of lead. Two cars of first-class oxidized lead ore were shipped from the Columbus Rexall mine, a car of oxidized copper-lead ore was shipped from the Hellgate mine, and a small quantity of siliceous gold ore was shipped from the Clementine property.

Bingham or West Mountain district.—Twenty mines in the Bingham district in 1930 produced ore yielding on the average $3.19 in metals a ton, compared with $3.71 in 1929. Shipments of first-class ore amounted to 177,602 tons, compared with 203,035 tons in 1929; the output of concentrating ore was 9,957,298 tons, compared with 18,312,047 tons in 1929; and the quantity of concentrates produced was 426,130 tons, compared with 645,106 tons in 1929. The ore of smelting grade, amounting to 177,602 tons, consisted chiefly of copper, lead, and copper-lead sulphides; it yielded 21,366.52 ounces of gold, 742,552 ounces of silver, 7,263,727 pounds of copper, and 13,735,833 pounds of lead, valued in all at $2,358,644, or $13.28 in metals a ton. The milling ore (9,957,298 tons) produced 426,130 tons of copper, lead, zinc, iron, and copper-lead concentrates yielding 84,459.31 ounces of gold, 2,774,565 ounces of silver, 164,616,399 pounds of copper, 71,436,667 pounds of lead, and 44,724,792 pounds of zinc, valued in all at $29,932,891, or $70.24 in metals to a ton of concentrates. In addition copper precipitates recovered from mine water and from leaching of ore in place yielded 3,189,620 pounds of copper, valued at $414,651.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Utah, 1929 and 1930, and total, 1865–1930, in terms of recovered metals

Year	Mines producing	Ore and old tailings	Gold	Silver	Copper [1]	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	20	[2] 18,515,213	$3,328,035	4,644,955	[3] 311,891,841	98,894,016	43,588,545	$69,803,927
1930	20	10,134,900	2,187,614	3,517,117	[4] 175,069,746	85,172,500	44,724,792	32,706,186
Total, 1865–1930		([5])	[6] 57,962,043	[6] 83,381,774	4,170,341,482	2,048,304,930	328,758,824	948,399,464

[1] Includes copper saved from precipitates.
[2] Includes 131 tons of old tailings sold to a smelter.
[3] Includes 6,812,905 pounds of copper saved from precipitates.
[4] Includes 3,189,620 pounds of copper saved from precipitates.
[5] Figures not available.
[6] Includes placer production.

NOTE.—Total dividends, 1865–1930, $233,142,563.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Utah, in 1930, by classes of ore, in terms of recovered metals

Class of ore	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	8	3,765	1,545.39	55,207	39,063	145,843	
Copper	8	9,688,988	80,227.16	876,628	[1] 170,489,633	396,956	
Lead	13	50,971	3,306.29	389,762	514,518	13,813,581	
Copper-lead	2	52,370	2,503.13	122,680	2,184,324	2,290,918	
Lead-zinc	12	338,806	18,243.86	2,072,840	1,842,208	68,525,202	44,724,792
	[2] 20	10,134,900	105,825.83	3,517,117	175,069,746	85,172,500	44,724,792

[1] Includes 3,189,620 pounds of copper saved from precipitates.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

According to its annual statement the Utah Copper Co.[6] during 1930 produced 9,552,500 tons of copper ore, a marked decrease from 17,724,100 tons produced in 1929; the ore contained 0.973 per cent of copper, or 19.46 pounds a ton. This low-grade material was mined by electric shovels and treated chiefly at the Magna flotation plant; the Arthur plant was active only the first three weeks of the year. Metals recovered from concentrates during 1930, together with 1,055,291 net pounds of copper recovered from mine-water preciptates, amounted to 161,138,717 pounds of copper, 563,330 ounces of silver, and 64,239.88 ounces of gold, valued in all at $20,698,585, compared with $52,563,219 in 1929. The copper concentrates shipped to the smelter contained 165,444,216 pounds of copper, or 32.25 per cent, in 1930, compared with 302,013,015 pounds, or 32.06 per cent, in 1929. The company was not only the largest producer of copper and gold in Utah in 1930 but ranked sixth in the production of silver and eleventh in lead. The company also curtailed operations in the sulphide or underground section of its property, and during the latter part of the year work was limited to development; about 5,800 linear feet of development was done in 1930. A total of 22,828 tons of sulphide lead-zinc ore, lead ore, and copper ore was shipped from the underground section, a decided decrease from 61,140 tons shipped in 1929. About half the output was first-class silver-lead ore of smelting grade, and the remainder was first-class copper ore of smelting grade and lead-zinc ore of milling grade.

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[6] Utah Copper Co. Twenty-sixth Ann. Rept., for year ended Dec. 31, 1930.

After all operating charges of production, including the cost of marketing refined copper, were deducted the direct profits from mining operations for the year were $6,501,452, compared with $29,862,765 in 1929. Indirect earnings for the period, accruing as miscellaneous income incident to operations in Utah, amounted to $486,301 which, together with income of $3,403,553 from outside investments, made a total income of $10,391,306, compared with $37,528,523 in 1929. The audit report shows deductions for other charges, including depreciation of plant and equipment and obsolescence or retirement of property, aggregating $1,501,924, leaving a net income carried to surplus account of $8,889,382, or approximately $5.47 per share of capital stock outstanding. No charges were made for Federal income-tax requirements as they were covered by surplus reserves brought forward from the preceding year.

Dividends paid to stockholders in 1930 amounted to $10 a share, or a total of $16,244,900. The aggregate distribution to stockholders to December 31, 1930, was $218,726,003, or $134.64 a share of present outstanding capital stock. A revised calculation of developed ore reserves on December 31, 1930, as they will be mined, gave approximately 640,000,000 tons of milling ore averaging about 1.07 per cent of copper. The total ore mined to the end of 1930 has been 203,421,177 tons; thus, the total ore mined and to be mined, from the beginning of mining to the exhaustion of the estimated reserves, approximates about 843,400,000 tons. Since the early production in 1904 the mine has yielded 3,483,513,432 pounds of refined copper—3,457,765,162 pounds from the treatment of 202,284,574 tons of milling ore and the remainder (25,748,270 pounds) from miscellaneous mine products.

The mining cost for 1 ton of ore milled, including a proper apportionment of fixed, general, and stripping charges (but not including Federal taxes and depreciation), was 50.43 cents, of which 24.16 cents represents stripping charges. This amount covered the cost of all stripping actually removed during the year and an apportionment of similar charges, previously deferred. The actual direct mining cost of all ore was 26.27 cents a ton, of which 13.22 cents represents all mine charges; the remainder (13.05 cents) represents overhead expense. An interesting paper[7] issued in February reviews the history and general geology of the Utah Copper property and gives details on mining methods and costs.

The ore treated at the Magna and Arthur plants was 9,552,500 tons, nearly all of which was treated at the Magna plant. The average content of the ore was 0.973 per cent of copper, compared with 0.994 per cent in 1929; the average recovery in the form of concentrates was 89 per cent, or 17.32 pounds to the ton, compared with 85.67 per cent, or 17.04 pounds, in 1929. The average milling cost was 46.09 cents a ton, an increase from 36.58 cents a ton in 1929.

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[7] Soderberg, A., Mining Methods and Costs at the Utah Copper Co., Bingham Canyon, Utah: Inf. Circ. 6234, Bureau of Mines, 1930, 23 pp.

Operations at the large concentration plants at Magna and Arthur were described in detail in a circular[8] published in 1931.

The average cost per net pound of copper, including depreciation of plant and equipment and all fixed and general expenses (except Federal taxes), and after gold, silver, and miscellaneous earnings were credited, was 8.47 cents, compared with 6.65 cents for 1929, computed on the same basis. The value of the gold and silver recovered and the miscellaneous earnings amounted to 1.23 cents per pound of copper, compared with 1.45 cents for 1929.

The meteoric waters percolating through the vast quantity of stripping or overburden, hauled to various gulches near Bingham, dissolve a minute percentage of copper. These solutions are collected in conduits and pipe lines and conveyed to the new plant at the mouth of Bingham Canyon, from which copper precipitates were shipped in 1930 containing 1,055,291 net pounds of copper, a decided decrease from 4,420,460 pounds in 1929. This decrease was due chiefly to the diminished flow of water resulting from the unusually light snowfall of the previous winter. The company report continues:

> At the beginning of the year unsold copper in inventory was carried at 13.50 cents per pound and at the end of the year at 10.50 cents. Charges were made to surplus to cover this reduction in inventory price as well as adjustments yet to be made in export copper for which items a reserve has been established.
>
> Further curtailments in output were made during the year to prevent the greater accumulation of unsold copper and a corresponding tie-up of cash. At the end of the year your company was operating at a rate below 40 per cent of its producing capacity. Another occurrence during the year which adversely affects your company's industry was the creation by the State of Utah of a revised system of taxation whereby the tax burden upon your company, already heavy, will be increased. * * *
>
> The mining ground owned in the Bingham district was increased during the year and now totals 1,024.22 acres. In addition to this the company owns or controls surface rights on 796.15 acres, also 12,322.07 acres of land other than lode claims and surface rights which includes lands in the Garfield district.
>
> While development by churn drilling aggregating 6,166 feet for the year indicated prospective extensions of the ore body and developed ore probably in excess of that mined during the year, the results of these developments were not fully calculated into ore reserves which may again be stated at approximately 640,000,000 tons of ore estimated to average 1.07 per cent copper. * * *
>
> The overburden excavated and disposed of during the year amounted to 6,666,690 cubic yards, a decrease of 30 per cent from that of the previous year. This work has expanded the area covered by mining and stripping operations to about 439 acres.
>
> In the latter part of November a rock slide in the upper part of the mine partially displaced or covered 10 levels. The damage was confined almost entirely to the stripping area leaving practically all ore faces intact. No detriment to the production of ore resulted, nor was the physical condition of the mine impaired for meeting future ore requirements. The policy of maintaining large completely stripped ore reserves has long been followed at the mine to insure uninterrupted production in event of such an emergency.
>
> The electrification of the mine haulage system was continued during the year in extending the electrically operated tracks to the higher levels and to the east side of the mine now being prepared for production. Shops for repairing dump cars and sharpening drill steel were erected. A canal was excavated to divert the waste water from the precipitation plant below Bingham to the tailing pond at Magna. Twenty-four new dwellings were added to the housing facilities for employees and their families at the company's townsite at Copperton.
>
> The total ore treated at the concentrating mills at Garfield amounted to 9,552,500 dry tons. Practically this entire tonnage was treated at the Magna plant, the Arthur plant having been operated only during the first three weeks of the year. * * *

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[8] Martin, H. S., Milling Methods and Costs at the Arthur and Magna Concentrators of the Utah Copper Co.: Inf. Circ. 6479, Bureau of Mines, 1931, 27 pp.

A few additions to fine crushing, grinding, concentrate dewatering, and pumping facilities were installed at the Magna plant.

The increase in mining, milling, and metal costs is due entirely to curtailment of operations and production which were reduced as an average for the year to less than 50 per cent and in the later months to below 40 per cent of capacity.

The railroad yard for loaded and empty ore cars at the Arthur plant was raised to the elevation of the car dumper to eliminate the incline heretofore used in ore delivery and thus permit direct service by electric switching locomotive, the operation now being similar to that in use at the Magna plant.

In order to most economically effect further decrease of production, operations were suspended at the Arthur plant January 25, 1930. A skeleton organization, foundry crew and joint employees were retained and others of the operating crew were transferred to the Magna plant. A plan of rotating employees was put in operation which permits the combined forces to work approximately 60 per cent of the time. This rotation practice was also put into effect at the mine to make possible the retention of a maximum number of employees on the payroll.

The output of the United States Smelting, Refining & Mining Co. mines [9] at Bingham (United States and Lark groups) amounted to about 316,000 tons of ore in 1930, an increase of nearly 50,000 tons over that in 1929. The output of lead-zinc ore from the original property (United States group) of the United States Smelting, Refining & Mining Co. increased more than 14 per cent; and the output of ore, chiefly lead-zinc ore, from the Lark group increased nearly 30 per cent. With the exception of a little more than 48,000 tons, chiefly copper ore of smelting grade, the entire output was lead-zinc ore treated at the flotation plant at Midvale, which separated the galena-sphalerite-pyrite ore into lead, zinc, and iron concentrates. Both the lead and the iron products were treated locally at the Midvale lead smelter, and the zinc concentrates were shipped mainly to Great Falls, Mont. The United States Smelting, Refining & Mining Co. was the largest producer of lead and zinc in Utah in 1930 and ranked third in production of silver and copper and fourth in gold.

Details regarding production and the developed ore reserves are not published in the company's printed annual report, but the statement given to the industrial commission credited the main group (United States mines) with an output of 236,699 tons of first-class and milling ore containing 17,724 ounces of gold, 1,064,497 ounces of silver, 2,845,790 pounds of copper, 48,717,119 pounds of lead, and 43,968,457 pounds of zinc. The gross proceeds amounted to $2,326,457; and after various expenses, including the cost of extraction, freight and smelter charges, and cost of repairs, were deducted the net proceeds were $180,453. Development in 1930 consisted of 15,791 feet of drifting and 3,267 feet of raising. This work was said to have opened considerable new lead-zinc ore.

The Lark group of the United States Smelting, Refining & Mining Co. was worked continuously in 1930; the output of ore, chiefly lead-zinc ore, was considerably more than in 1929. Substantial increases were made in production of all five metals, especially silver, lead, and zinc. The published figures do not represent the contents of the concentrates marketed but the contents of both the first-class ore directly smelted and the milling ore, chiefly the latter. According to a report to the industrial commission 79,378 tons of smelting ore and mill ore shipped from the Lark group contained 2,421 ounces of gold, 736,916 ounces of silver, 1,110,017 pounds of copper, 16,352,940 pounds of lead, and 11,504,500 pounds of zinc. The gross proceeds amounted to $646,813; and after various expenses, including cost of extraction, freight and smelter charges, and cost of repairs, were deducted there was a net loss of $40,256. Development in 1930 consisted of 12,227 feet of drifting and 2,082 feet of raising.

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[9] United States Smelting, Refining & Mining Co. Twenty-fifth Ann. Rept., for year ended Dec. 31, 1930.

The Niagara property, controlled and operated by the United States Smelting, Refining & Mining Co., produced more siliceous gold and silver ore but less lead-zinc ore than in 1929. There was, therefore, an increase in the output of gold and silver from the Niagara mine and a decrease in the output of copper, lead, and zinc. About 2,500 tons of siliceous gold and silver ore were shipped to Garfield for smelting, and more than 8,500 tons of lead-zinc ore were milled in the custom flotation plant at Midvale; several cars of first-class oxidized silver-lead ore were also shipped for smelting. According to a report to the industrial commission the mine produced a total of 11,038 tons of ore containing 4,920 ounces of gold, 206,300 ounces of silver, 66,938 pounds of copper, 947,175 pounds of lead, and 867,200 pounds of zinc. The gross proceeds were $174,395; and after $136,570 was deducted for extraction, transportation, reduction, and construction the net proceeds were $37,825. The property was worked most of the year, and development consisted of 1,044 feet of drifting and 257 feet of raising. The annual report of the United States Smelting, Refining & Mining Co. continues:

> Additions to mines and reduction plants, etc., in the United States include purchase of a number of mining claims adjoining the present holdings at Bingham, Utah, and miscellaneous additions and improvements at the plants of the coal and metal mines and at the reduction works. There is also included the purchase of additional outstanding securities of affiliated companies.
>
> * * * Exploration and development programs are being actively carried on at the U. S. mine and the Lark mine at Bingham, with good results. Ore reserves are substantially increased, grade is better, and outlook for the future is good.

The Utah-Delaware Mining Co. worked the Highland Boy and Yampa groups at the head of Carr Fork and produced 87,414 tons of ore, a decided decrease from 196,203 tons produced in 1929. The output of lead-zinc ore decreased more than 74,000 tons and that of lead ore nearly 25,000 tons; there was also a decrease in the output of copper ore. Nearly 90 per cent of the mine output in 1930 was copper ore of milling and smelting grade, and most of the remainder was sulphide lead ore of milling grade. An aerial tramway takes the ore, as well as some custom material from Bingham, to the International mill and smelters. The property ranked second in production of copper in Utah in 1930 and seventh in gold, and it was also a large producer of silver and lead. The mine is extensively developed, and in 1930 more than 12,400 feet of work was done. Details regarding ore reserves and costs are not made public. The contents of the first-class ore directly smelted and the milling ore from the Utah-Delaware mine as reported to the industrial commission follow: 10,008 ounces of gold, 142,336 ounces of silver, 4,321,026 pounds of copper, 2,217,247 pounds of lead, and 336,163 pounds of zinc. The gross proceeds were $809,049, compared with $1,563,209 in 1929. After charges for extraction, transportation, reduction, and construction and repairs were deducted the net loss was $78,612. The metal output represents a marked decrease from that in 1929, when the property produced 196,203 tons of ore containing 14,843 ounces of gold, 403,683 ounces of silver, 5,461,275 pounds of copper, 17,369,460 pounds of lead, and 5,419,410 pounds of zinc.

The Utah-Apex Mining Co. worked its mine continuously throughout the year, but its output of ore decreased 89,921 tons from that in 1929. The company's 700-ton flotation mill at Bingham was operated until July 15, when it was closed on account of low metal prices; this resulted in a decided decrease in the milling of lead-zinc ore and copper-lead ore. There was, however, a large increase in the shipments of sulphide lead ore of smelting grade. About half of the total output in 1930 was copper-lead ore of milling and smelting grade, and the remainder was chiefly lead-zinc ore milled. According to a report to the Bureau of Mines for the calendar year 1930 the company produced 101,874 tons of ore, of which 50,020 tons (32,017 tons of copper-lead ore and 18,003 tons of lead ore) were shipped to the smelters, 49,990 tons of copper-lead ore and lead-zinc ore were milled in the company's flotation mill, and 1,864 tons of lead-zinc ore were shipped to the sulphide mill of the International Smelting Co. near Tooele. The lead concentrates, zinc concentrates, and copper-lead concentrates (9,246 tons in all) contained 1,092.10 ounces of gold, 110,367 ounces of silver, 774,079 pounds of copper, 6,832,025 pounds of lead, and 2,343,757 pounds of zinc. The lead-zinc ore shipped to the International mill contained 54.28 ounces of gold, 5,202 ounces of silver, 27,131 pounds of copper, 331,417 pounds of lead, and 137,091 pounds of zinc. The first-class smelting ore consisted of 32,017 tons of sulphide copper-lead ore (containing 1,933.58 ounces of gold, 80,798 ounces of silver, 1,840,890 pounds of copper, 902,227 pounds of lead, and a little zinc) and 18,003 tons of sulphide lead ore (containing 633.24 ounces of gold, 84,172 ounces of silver, 324,888 pounds of copper, 5,275,761 pounds of lead, and 2,520,232 pounds of zinc, the zinc being lost in smelting). The company reported to the industrial commission a total of 101,874 tons of ore extracted and gave the contents of the crude ore and concentrates shipped as 3,713 ounces of gold, 280,539 ounces of silver, 2,966,988 pounds of copper, 12,838,230 pounds of lead, and 5,001,080 pounds of zinc; more than half the zinc was lost in smelting first-class lead ore. The gross proceeds amounted to $896,066; and after $1,026,629 was deducted for various costs, including chiefly extraction and reduction, the net loss was $130,563. In 1929, 6,325 ounces of gold, 409,552 ounces of silver, 4,601,550 pounds of copper, 17,043,440 pounds of lead, and 9,441,272 pounds of zinc sold for $2,095,032, and after $2,019,457 was deducted for various costs the net proceeds were $75,575. No dividends were paid by the company in 1930; but it ranked fourth in Utah in the production of copper, fifth in zinc, seventh in lead, eleventh in gold, and twelfth in silver. The mine is developed by a main vertical shaft and winze to the 3,400-foot level and by various drifts, crosscuts, raises, and tunnels. In 1930 development consisted of 10,160 feet of drifting and crosscutting, 1,236 feet of raising, and 242 feet of sinking; the company also removed 9,240 cubic feet of material in cutting stations and pockets. The improved flotation plant in Carr Fork near Bingham has a capacity of 700 tons of ore a day, but it was idle nearly half the year; the ore contains chiefly sphalerite, chalcopyrite, galena, and bornite. New discoveries of rich lead-zinc ore on the 1,150 and 1,300 foot levels and of rich copper ore on the 3,100-foot level were reported to have increased the ore reserves greatly. The company's printed report for the year ended August 31, 1931, gave the following notes for the fiscal year.

> The most notable development has been in the eastern part of the property on the 2,900, 3,100, and 3,200 levels, where it is estimated that approximately 600,000 tons of probable ore has been discovered, assaying approximately 2.25 per cent of copper. This ore body is found along the Yampa vein and in close proximity to it. Most of the development work during the year has been done in this region. The 3,300-foot level is now approaching a point where the extension of the western end of this ore body should be found.
>
> In addition to this copper ore development, the discovery of lead-zinc ore bodies of excellent grade on the 3,200 and 3,300 levels has been very gratifying. It is estimated that these ores contain 12 per cent to 15 per cent lead with 10 per cent to 12 per cent zinc and the estimated tonnage of this class of ore now developed between the 2,900 and 3,300 levels is approximately 45,000 tons.
>
> In the western part of the mine, we have found a continuation of the 3,100-20 ore body on the 3,300 level which was missed on the 3,200 level. This ore contains 3 per cent copper with 2.5 per cent lead and somewhat higher gold and silver values than does the ore from the eastern ore body.
>
> In general the results obtained in exploration and development work during the past year have been satisfactory and have increased the company's ore reserve, which may be estimated as follows:
>
> Eighty-five thousand tons of lead-zinc ore averaging 0.03 ounce of gold, 3.00 ounces of silver, 12.0 per cent of lead, 0.75 per cent of copper, and 10.0 per cent of zinc; 50,000 tons of copper ore (west) averaging 0.07 ounce of gold, 2.50 ounces of silver, 2.0 per cent of lead, and 3.50 per cent of copper; and 600,000 tons of copper ore (east) averaging 0.02 ounce of gold, 0.80 ounce of silver, 0.5 per cent of lead, and 2.23 per cent of copper.

Leaching of ore in place continued during 1930 at the property of the Ohio Copper Co.[10] at Lark, but the production of copper decreased as it has done since 1924. In 1930 the output of copper recovered from precipitates was 2,048,369 pounds, compared with 2,215,178 pounds in 1929. Operations resulted in a loss of $52,724, due to the pronounced drop in the price of copper, although the cost of producing copper was reduced to 13.264 cents a pound. Development was continued in the limestone area of the mine, and 1,300 tons of ore containing an average of $4 in gold and 1.72 ounces of silver to the ton and 1.92 per cent of copper were shipped for smelting. The company's report continues:

> The total amount of work amounted to 3,309 feet, of which 2,518 feet was in drifts and crosscuts and 791 feet in raises and winzes. In addition there was 2,361 feet of diamond drilling. Save for a few feet of crosscutting on the Mascotte level, all of this work was on the 700 level, or on sublevels above or below the 700. The work has been done economically and with constantly increasing efficiency.
>
> The campaign of development concluded early in 1931 has explored the three main ore-bearing limestone beds of the Bingham district. The "Commercial" or upper limestone was developed extensively on both the Mascotte and the 700 levels. The narrow "Yosemite" or Lark limestone was also developed on both levels. The "Jordan" or lower limestone does not extend up to the Mascotte level in the Ohio property, but it was developed on the 700 level and on sublevels above and below the 700. Still lower limestone beds will enter Ohio ground at considerably greater depth and have not yet been explored.
>
> Both on the Mascotte and on the 700 level the limestone is cut by many strong mineralizing fissures. Along them, and extending out on the bedding from them, the limestone is replaced by sulphides, chiefly of iron. Some of these replacement bodies of iron pyrite are several hundred feet long and 20 to 100 feet wide. With the iron sulphide there are smaller bodies of copper, lead, and zinc sulphides, carrying gold and silver. The copper-gold ore is in bodies large enough to be commercial at a high copper price. * * *

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[10] Ohio Copper Co. of Utah Ann. Rept. for year ended Dec. 31, 1930.

> The following program is therefore recommended as soon as funds are available. First sink the shaft to the 1,200-foot level; then crosscut through the three limestone beds; and then follow any mineralized fissures. * * *
>
> Experimental work on treatment of the 4,000,000 tons or more of tailings carrying 0.45 per cent copper was carried out most successfully. It showed that, at least in the outer portion of the dump, about half the copper is soluble in discard water from the precipitation plant in the Mascotte tunnel. About 80 per cent of this soluble copper can be recovered at a cost of 16 cents per ton of tailings, or 5 cents per pound of copper recovered, by a very simple plant consisting of hydraulicking apparatus, settling ponds, and precipitation boxes. A plant was built for about $25,000, with an estimated capacity of 3,000 tons per day of tailings, or 10,000 pounds of copper per day. Extremely cold weather made it impossible to operate this plant for more than a few days after it was completed, on October 21. The few days operations seemed to bear out the experimental work. * * *
>
> Material deeper in the tailings pile will have to be treated by flotation, following the leaching where there is a large soluble copper content. Experiments proved that by the combined process, or by flotation alone where the oxidized content is small, a total recovery of more than 6 pounds of copper per ton of tailings can be made at a cost of about 6 cents per pound. * * *

The ore output of the Utah Metal & Tunnel Co. in 1930 was 18,783 dry tons, a decrease of 14,030 tons from that in 1929. The ore had a gross value of $174,778, compared with $286,936 in 1929. About 62 per cent of the output was lead-zinc ore carried by an aerial tramway to International for milling; nearly all the remainder was first-class copper ore of smelting grade. Development in 1930 under the management of the Utah-Delaware Mining Co. consisted of 8,404 feet of work, chiefly in drifts and crosscuts, compared with 6,804 feet in 1929. The company received $174,778 from the sale of ore and $6,598 from other sources, chiefly the sale of water, which made a total income of $181,376. After $112,346 was deducted for mining, $56,032 for smelter charges, and $28,799 for miscellaneous expenses there was an operating loss of $15,801. Development costs, including interest on money advanced for development and interest on bonds, were $80,272; the net loss, including $8,599 for depletion and depreciation, was $104,672. The annual report [11] of the company gives the following ore output for 1930: 18,783 tons of first-class smelting ore and milling ore yielding 2,348 ounces of gold, 71,003 ounces of silver, 457,434 pounds of copper, 2,342,882 pounds of lead, and 741,244 pounds of zinc. A decrease was reported in the production of each of the metals except copper; the decrease in lead and zinc was especially large. The report continues:

> Owing to the drop in the price of metals the management early in 1930 decided to discontinue company operations and do all development and mining of ore through lessees. All work by the company on the lower levels of the mine was stopped until further geological examinations could be made to determine, as far as possible, the relative value of the underlying lime beds.
>
> * * * In February, 1931, a sale was made to the Utah Copper Co. by this company of the surface rights on approximately 92 acres of land, for which the Utah Metal Co. received $250,000 ($150,000 in cash and the balance of $100,000 in a 1-year note of the Utah Copper Co.) and a 20-year lease on 42 acres of mineral lands owned by the Utah Copper Co.
>
> As the company is now free from all bonded indebtedness and in a better financial position than it has been for years, the directors determined to take advantage of the prevailing low costs to make plans to develop the property under the present favorable conditions. * * *
>
> Under our 1918 agreement and the subsequent 1926 agreement, the lime beds underlying the Highland Boy limes in the Utah-Delaware Co. property belong to the Utah Metal & Tunnel Co. The report indicates that these limes

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[11] Utah Metal & Tunnel Co. Ann. Rept. for year ended Dec. 31, 1930.

> may be productive and should become a major development operation of the company. * * *

The Bingham Prospect Mining Co. operated its property near Lark the entire year and shipped 5,129 tons of first-class silver-lead ore to the smelter at Murray and 6,457 tons of zinc-lead ore to the custom flotation mill at Midvale. These ores contained 331.82 ounces of gold, 367,468 ounces of silver, 70,137 pounds of copper, 2,292,379 pounds of lead, and 2,527,135 pounds of zinc, a marked decrease from the metal output in 1929, when 27,928 tons of ore contained 1,113.57 ounces of gold, 984,877 ounces of silver, 181,862 pounds of copper, 7,100,688 pounds of lead, and 4,089,096 pounds of zinc. The mine is opened by an inclined shaft and a tunnel 5,000 feet long; in 1930 development consisted of 5,500 feet of drifting, crosscutting, and tunneling. The chief development project in 1930 was the work of advancing the Congor tunnel or 500-foot level 1,900 feet to connect with the mine workings. When the connection was completed ore was hauled through the new tunnel directly to the railroad bins, thus eliminating the use of the inclined shaft.

The output of ore from the New England property owned by the Bingham Metals Co. was nearly the same as in 1929. The output in 1930 consisted of 1,545 tons of siliceous gold ore, first-class sulphide lead ore, and lead-zinc ore. The company's report to the industrial commission gave 1,545 tons of ore, including both milling ore and first-class smelting ore, containing 439 ounces of gold, 11,481 ounces of silver, 22,957 pounds of copper, 286,092 pounds of lead, and 149,524 pounds of zinc. The mine was formerly operated through the Nast inclined shaft and the Bingham Metals vertical shaft. During 1930 the Utah Copper Co., in exchange for certain dumping rights on the Bingham Metals ground, advanced the Armstrong tunnel to a point 4,400 feet from the portal where a connection was made with the 710-foot level of the shaft of the Bingham Metals Co. When the work was completed the New England mine was operated through the Armstrong tunnel, and the Nast inclined shaft was abandoned. The old shaft was deepened 190 feet to the 1,100-foot level; and most of the development during the year, consisting of 672 feet of drifts and crosscuts and 136 feet of raises and winzes in addition to the shaft sinking, was done on the new level.

The New Bingham Mary property, adjoining the Utah-Apex mine, was worked nearly all year, and 1,434 tons of copper-lead ore were treated in the flotation mill of the Utah-Apex Mining Co. In addition to the copper-lead ore 90 tons of first-class silver-lead ore were shipped to Murray for smelting. According to a report to the industrial commission the mine produced 1,524 tons of milling and smelting ore containing 105 ounces of gold, 6,062 ounces of silver, 45,765 pounds of copper, 238,027 pounds of lead, and 35,313 pounds of zinc. The property is opened by drifts and crosscuts from the 1,000, 1,050, and 1,150 levels of the Utah-Apex mine, and 450 feet of drifting and 100 feet of raising were done in 1930. Early in 1931 control of the property was obtained by the Utah-Apex Mining Co.

The Silver Shield and Bully Boy properties, owned by the Park-Bingham Mining Co., were operated partly on company account and partly by lessees. The output of ore increased slightly—from 1,826 tons in 1929 to 1,859 tons in 1930. The entire output was shipped to Midvale, where more than half of it was milled in the flotation plant and the remainder was directly smelted. The company spent most of the year cleaning out the old workings.

Other producers in the West Mountain district were the Bingham Bemis, Osceola-Lucky Boy, Queen and Little Queen (Lavagnino group), Standard, and Montana-Bingham Consolidated properties. Several operators at Bingham continued to make copper precipitates by running copper-bearing water over scrap iron; the precipitates were shipped to Garfield and Tooele for smelting.

Smelter district (*Midvale and Murray*).—The output of the Smelter district in 1930 consisted of several hundred tons of old tailings containing chiefly silver and lead from the old mill of the United States Smelting, Refining & Mining Co. and a little matte containing silver, lead, and copper from the old smelter dump at Sandy.

At Midvale the lead smelter of the United States Smelting, Refining & Mining Co.[12] treated custom ore and concentrates from Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, and Utah and produced about 37,000 tons of lead bullion, a decrease of nearly 3,000 tons compared with 1929. The smelter is equipped with seven blast furnaces, bag house, Cottrell plant, and Dwight-Lloyd sintering machines. The products, in addition to the usual shipments of lead bullion and lead-copper matte, are refined arsenic, weed killer, and cadmium. From 1919 to 1927, according to the company's annual reports, the works produced 354,248 tons of lead bullion, an average of 39,361 tons a year; no exact figures are given for 1928, 1929, and 1930 relative to the bullion output or its metal content.

The new flotation plant at Midvale, a modern steel and concrete structure, treated on the average 891 tons of lead-zinc-iron ore a day, an increase over the average feed in 1929. From 1919 to 1930 this new flotation mill and the old wet concentration mill treated about 2,355,600 tons of ore, chiefly from the company's mines at Bingham. A detailed description [13] of the operations of the mill was published in 1931.

At Murray the American Smelting & Refining Co. operated its lead plant, equipped with sampling mills, roasters, bag house, and blast furnaces; the bullion output in 1930 decreased about 16,500 tons from that in 1929. The plant has been in operation more than 22 years. Lead bullion is shipped East for refining, lead-copper matte to the company's copper plant at Garfield, and arsenic dust to Colorado and California. The plant was described [14] in the technical press during 1930.

SAN JUAN COUNTY

Big Indian district.—The Big Indian Copper Co. operated its mine and 100-ton flotation mill until May, when the price of copper dropped so low that the company was compelled to shut down the mill and cease all operations. During the early part of the year the output consisted of several hundred tons of copper ore, which were treated in the flotation plant and resulted in the shipment of 107 tons of concentrates containing 44,560 pounds of copper and a little silver. The concentrates were hauled 70 miles to Thompsons, the nearest shipping point on the Denver & Rio Grande Western Railroad. The ore, which occurs in sandstone and contains about 3.5 per cent of copper, consists chiefly of azurite and malachite with a little native copper.

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[12] United States Smelting, Refining & Mining Co. Twenty-Fifth Ann. Rept., for year ended Dec. 31, 1930.

[13] Pallanch, R. A., Milling Methods at the Midvale Concentrator of the United States Smelting, Refining & Mining Co., Midvale, Utah: Inf. Circ. 6492, Bureau of Mines, 1931, 19 pp.

[14] Huttl, J. B., The Murray Lead Smelter: Eng. and Min. Jour., vol. 129, May 23, 1930, p. 509.

SEVIER COUNTY

Redmond district.— The Salina Lead-Zinc Co., which owns several claims about 2 miles east of Redmond, did a little work in 1930 and shipped two cars of first-class oxidized lead-zinc ore to an eastern zinc plant. The ore contained an average of 4 per cent of lead and 27 per cent of zinc.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

The Blue Ledge and Snake Creek districts in Wasatch County and the Uintah district in Summit County represent the producing area of the Park City region.

Mine production of gold, silver, copper, lead, and zinc in Park City mining region, Utah, 1929 and 1930, and total, 1870–1930, in terms of recovered metals

Year	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	11	[1] 777,909	$428,364	6,157,501	2,524,324	85,139,968	55,929,712	$13,209,772
1930	10	[2] 456,387	360,282	4,212,403	1,678,415	61,749,780	39,085,269	7,163,833
Total, 1870–1930		([3])	8,049,184	199,401,578	54,062,149	1,958,571,369	332,306,387	287,627,721

[1] Includes 251,228 tons of old tailings.

[2] Includes 100,565 tons of old tailings.

[3] Figures not available.

NOTE.—Total dividends, 1870–1930, $64,094,652.

Mine production of gold, silver, copper, lead, and zinc in Park City mining region, Utah, in 1930, by classes of ore, in terms of recovered metals

Class of ore	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	5	1,646	65.48	31,560	4,403	28,654	
Lead	5	[1] 1,591	74.99	40,487	19,692	513,897	
Lead-zinc	10	[2] 453,150	17,288.17	4,140,356	1,654,320	61,207,229	39,085,269
	[3] 10	456,387	17,428.64	4,212,403	1,678,415	61,749,780	39,085,269

[1] Includes 565 tons of old tailings sold to a smelter.

[2] Includes 100,000 tons of old tailings reconcentrated.

[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

The production of gold, silver, copper, lead, and zinc in the Park City region was much less than that in 1929, as the output of ore from the chief producers in the region decreased considerably due to the drop in metal prices. Milling of ore in the region is done chiefly at the modern 800-ton flotation plant of the Silver King Coalition Mines Co. The Judge mill treated lead-zinc ore from the Daly Judge and Daly West mines, which constitute the Park City unit of the Park

Utah Consolidated Mines Co.; it is a combined gravity and flotation plant and makes lead concentrates which are shipped for smelting, lead-zinc-iron middlings which are re-treated at the International custom flotation plant, and flotation lead concentrates from primary slimes.

The Silver King Coalition Mines Co.[15] produced 233 tons of first-class ore (including 88 tons of lease ore), which were shipped for direct smelting, and 155,717 tons of second-class or mill ore—a total of 155,950 tons. The output of milling ore decreased decidedly, resulting in a general decrease in gold, silver, copper, and lead recovered from concentrates; the production of zinc, however, increased slightly. After smelter and freight charges were deducted the company received $2,403,733 from sales of ore and concentrates, compared with $4,088,419 in 1929; after other income ($61,315) was added, the total income for 1930 was $2,465,048. After $1,740,981 was deducted for mining and milling costs, $48,351 for taxes, and $131,183 for other charges (including $73,611 for depreciation), a net income of $544,533 remained, compared with $1,748,608 in 1929; the surplus on December 31, 1930, was $2,692,852. The milling ore yielded 27,659 tons of lead concentrates and 14,393 tons of zinc concentrates. The mine ranked second in production of silver and lead in Utah in 1930 and third in production of zinc. The accompanying table gives the total and average metal contents of all products from the property in 1930.

Gold, silver, copper, lead, and zinc contained in products of Silver King Coalition mine, Utah, in 1930

Kind of material	Gold		Silver	
	Total	Per ton	Total	Per ton
	Ounces	*Ounce*	*Ounces*	*Ounces*
First-class ore	7.99	0.0551	10,147	69.98
Lead concentrates	2,872.45	.1039	2,091,919	75.63
Zinc concentrates	224.04	.0156	144,433	10.03
Lessees' ore	7.07	.0804	4,372	49.68
	3,111.55	----------	2,250,871	----------

Kind of material	Copper		Lead		Zinc		Net smelter returns
	Total	Per cent	Total	Per cent	Total	Per cent	
	Pounds		*Pounds*		*Pounds*		
First-class ore	3,776	1.30	187,537	64.67	----------	----------	$8,861
Lead concentrates	1,139,503	2.06	35,716,470	64.57	----------	----------	2,151,935
Zinc concentrates	116,091	.40	773,607	2.69	17,021,463	59.13	242,309
Lessees' ore	3,000	1.70	41,094	23.35	----------	----------	2,580
	1,262,370	----------	36,718,708	----------	17,021,463	----------	2,405,685

During the year $526,792 was spent in development (29,606 feet of drifting, 2,935 feet of raising, and 572 feet of sinking). Dividends of $1,098,420 were paid in 1930, and a dividend of $183,070 was declared payable on January 2, 1931, making a total of $25,307,072. The company report says:

> Due to the drop in metal prices during the past year, the profits of your company were reduced approximately 69 per cent. The low unit prices received from

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[15] Silver King Coalition Mines Co. Ann. Rept. for year ended Dec. 31, 1930.

metals not only affected the net profits for the metal sold but also were a governing factor in determining the grade of ores that could be profitably mined. If metal prices remain at their present level it will be profitable for the company to discontinue the extraction of the lower grade ores until better metal prices prevail. At present metal prices the majority of the stopes in your property are being operated at a profit. * * * Depletion of ore reserves at present metal prices is discouraging and not very profitable. Considering the above, I would suggest that no dividends be paid by the company out of surplus and that actual earnings be used only for dividend disbursements during the coming year.

During the first quarter of the year metal prices remained at a fairly good level, normal production at the property was maintained, and a profit in excess of regular dividend requirements was made. Due to decreasing metal prices in the last three quarters of the year ore extraction was curtailed. * * *

Regardless of the fact that the declining metal prices continued throughout the year, development work was carried on vigorously, and the favorable results obtained from the new development work resulted in an additional tonnage of high-grade ore being developed and in materially increasing the ore reserves already blocked out. * * *

In an effort to reduce mine expenses, wages were reduced approximately 14 per cent. * * *

Mill operations show increased economical results with resultant profits to the company, very little research or experimental work being necessary during the year. Noticeable improvements in mill results are the increased lead and zinc content in the products, improvement in the separation of lead and zinc content in the concentrates, and increased recovery of zinc content from the mill tails.

The company owns 4,466 acres of patented ground all within the boundaries of mineralized zone in the Park City district. It also owns a one-third interest in a tract of land consisting of 768 acres used as a tailing impound dam. Only a small percentage of the company's holdings has been prospected; and development work done during the past year at greatest depth in the mine proves the uniform size, the continuity, and value of the ore bodies. * * *

Mining operations at the Silver King property are described in detail in an article[16] published in 1930.

The Park Utah Consolidated Mines Co. operated the Park City unit, consisting of the Daly West and Daly Judge properties, and the Park Utah unit, near Keetley, in the eastern part of the district in Wasatch County. The metal output from the Park Utah mine, as well as the production from the Park City unit, was much less than in 1929. The chief output of the Park Utah mine is lead-zinc ore containing galena, sphalerite, pyrite, and tetrahedrite. Nearly all the ore is shipped to International for milling where it is separated into zinc concentrates, lead concentrates, and iron concentrates. The lead and iron concentrates are smelted locally, but the zinc concentrates are shipped to the electrolytic plants at Anaconda and Great Falls, Mont. The Park Utah mine at Keetley is extensively developed by a 930-foot vertical shaft, an 800-foot inclined shaft, and several miles of drifts and tunnels; more than 7,000 feet of work was done in 1930, chiefly in drifting and crosscutting. The Judge mill in Empire Canyon, which treats ore from the Daly, Daly West, and Daly Judge mines, is a 450-ton wet concentration plant, including three Callow flotation cells used on primary slimes; the products are lead concentrates of smelting grade and lead-zinc-iron middlings which are re-treated by flotation at International. An aerial tramway 4,685 feet long takes the first-class ore and the mill products to the loading station at Park City. Most of the ore from the Daly West mine was lead-zinc ore hauled from the Daly West shaft through the Daly Judge tunnel to the Judge concentration mill. The mine was worked continuously in 1930, and more than 4,300 feet of development was done, chiefly in drifting and crosscutting. The Daly Judge mine was also worked regularly; development consisted of 6,827 feet of drifting, 2,374 feet of crosscutting, 1,089 feet of raising, and 562 feet of work in the winzes. This work was said to have opened considerable new ore.

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[16] Dailey, M. J., Mining Methods and Costs of the Silver King Coalition Mines Co., Park City, Utah, Inf. Circ. 6371, Bureau of Mines, 1930, 13 pp.

According to the annual report of the Park Utah Consolidated Mines Co. for 1930 the combined output of all mines—including the Ontario property—amounted to 171,750 tons of ore; ore and concentrates shipped contained 17,679 ounces of gold, 1,598,983 ounces of silver, 804,957 pounds of copper, 28,040,599 pounds of lead, and 34,073,606 pounds of zinc. There was a decided decrease in the quantity of ore milled and in its metal content. As in former years the zinc output as given not only includes zinc lost in milling but also zinc lost in the smelting of lead products. The bulk of the ore was milled, and about 22,500,000 pounds of zinc were recovered from the zinc concentrates made at International. The total metal contents of the ore and concentrates shipped in 1930 are shown in the table that follows.

Gold, silver, copper, lead, and zinc contained in ore and concentrates shipped from the properties under control of Park Utah Consolidated Mines Co., Utah, in 1930

Mine	Ore and concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Ounces*	*Ounces*	*Pounds*	*Pounds*	*Pounds*
Park City unit	62,770	1,084	351,929	161,183	13,536,674	16,946,748
Park Utah unit	104,741	16,453	1,090,270	612,331	14,225,553	16,715,031
Ontario	4,239	142	156,784	31,443	278,372	411,827
	171,750	17,679	1,598,983	804,957	28,040,599	34,073,606

The Park Utah Consolidated Mines Co., exclusive of the Ontario property, ranked second in production of zinc in Utah in 1930, fourth in production of silver and lead, and fifth in gold. The total metals contained in the crude smelting ore, concentrates, and milling ore of the property under control of the Park Utah Consolidated Mines Co. and the Ontario Silver Mining Co., from the date of discovery to the end of 1930, are given as follows: 231,710 ounces of gold, 126,727,194 ounces of silver, 36,953,959 pounds of copper, 741,115,619 pounds of lead, and 399,126,587 pounds of zinc. The total dividends paid to date by the companies now under the control of the Park Utah Consolidated Mines Co. have been $37,742,862; no dividends, however, were paid in 1930.

The Park Utah Consolidated Mines Co. received $1,426,563 in 1930 from the sale of ore and $93,833 from other income, making a total income of $1,520,396. After $1,050,932 was deducted for mining costs, $269,664 for development, $67,137 for milling, $58,039 for taxes, and $111,787 for other expenses, there was a net loss of $37,163 before depreciation and depletion. A deduction of $105,123 was made for depreciation, making a net loss for the year (exclusive of depletion) of $142,286, compared with a net income of $467,722 in 1929. A detailed description[17] of the operations of the Park Utah mine was published in 1930. The following paragraph is taken from the company's annual report.

> Development operations for the year have been maintained at a maximum speed, consistent with the policy of maintaining the net quick assets of the company on an approximate level. The results of this development and exploratory work, on which approximately two hundred and seventy thousand dollars was expended was to further bear out the conviction that the fertile areas of ground extend consistently beyond those territories which have been worked in past years. At the City unit new ore bodies have been exposed to the west of all ores previously found, and the year closed with this unit in an improved physical condition to that of the previous year. At the Utah unit it has been impossible to locate the downward extension of the eastern and western ore bodies, and the ore in sight in them has become limited. However, prospecting in a new section of this eastern territory has given encouraging results.

The Ontario Silver Mining Co., a separate incorporation controlled by the Park Utah Consolidated Mines Co., was operated until March, when the property was closed indefinitely on account of low metal prices. This resulted in a large decrease from the metal output in 1929. The output of 4,239 tons in 1930 was all lead-zinc ore shipped to the flotation mill of the International Smelting Co. According to a report to the industrial commission the milling ore contained 142 ounces of gold, 156,784 ounces of silver, 31,443 pounds of copper, 278,372 pounds of lead, and 441,827 pounds of zinc. The gross proceeds were $56,090, and after $47,170 was deducted for various costs the net proceeds were $8,920. The property of the Daly Mining Co. is also controlled by the Park Utah Consolidated Mines Co., which did 192 feet of crosscutting and 21 feet of drifting in 1930 but produced no ore.

The output of ore from the New Quincy property decreased decidedly—from 36,932 tons in 1929 to about 3,000 tons in 1930—due to exhaustion of the developed ore reserves. The mine was operated continuously (chiefly on development), and lead-zinc ore was shipped to the custom flotation plant at International. The company received $34,759 from the sale of ore and $435 from other income, making a total income of $35,194 for the year; after $163,461 for various expenses was deducted the net loss was $128,267. In 1929 the property was a large producer of silver, lead, and zinc, but the output in 1930 was comparatively small. The following paragraph is taken from the company's annual report.

> For some time past we have been working from 25 to 30 men at the mine all on development work, and up to date none of the headings being worked have opened up ore in a commercial quantity; they are just getting into the ore horizons where we are expecting results. * * *

The Park City Consolidated Mines Co., owning and leasing properties in Wasatch and Summit Counties, shipped 18,634 tons of ore in 1930, an increase of 16,634 tons over 1929. Most of the output was low-grade lead-zinc ore, containing more than 20 ounces of silver to the ton and a little gold and copper, from the Silver vein of the Roosevelt property, operated under lease. All the lead-zinc ore was shipped to the custom flotation mill at Midvale where it was separated into lead concentrates and zinc concentrates; about 1,000 tons of first-class siliceous silver ore containing a little gold, copper, and lead were shipped for smelting. The mine was worked continuously throughout the year; development consisted of 2,875 feet of drifting, 1,561 feet of raising, and 918 feet of sinking. According to the printed report of the company for the fiscal year ended October 31, 1930, the property produced, from June, 1929, to the end of October, 1930, 1,920 tons of carbonate ore averaging 40 to 60 cents in gold and 16.95 ounces of silver to the ton, and 12,356 tons of sulphide ore averaging 40 to 60 cents in gold and 20.43 ounces of silver to the ton, 1 to 2 per cent of lead, and 1.5 to 3.5 per cent of zinc. The company ranked tenth in production of silver in Utah in 1930. During October the company shipped 3,212 tons of siliceous ore containing an average of 21.64 ounces of silver to the ton and a little gold, copper, lead, and zinc. The cost of mining was $3.27 a ton, freight 80 to 85 cents a ton, and milling and smelting $1 a ton. After all costs were deducted the operating profit was $4,150. The completion of the new railroad spur to the mine in August reduced transportation costs; another item which contributes to the low costs is the fact that the mine is said to be dry to the deepest workings. The property is developed by a 400-foot vertical shaft, a 692-foot inclined shaft below the 400-foot level, and by more than 10,000 feet of drifts and raises. The following paragraphs are taken from the company's printed report for the fiscal year ended October 31, 1930.

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[17] Hewitt, E. A., Mining Methods and Costs at the Park Utah Mine, Park City, Utah: Inf. Circ. 6290, Bureau of Mines, 1930, 18 pp.

> Ore reserves amount to 29,485 tons of blocked sulphide ore, 17,576 tons possible sulphide ore, and 18,648 tons possible carbonate ore, or a total of 65,709 tons. The grade of the sulphide ore should be about the same as that already shipped, while the carbonate may be higher. The above estimate is based on ore reserves on the Silver vein above the 1,000 level; it includes only a small tonnage of ore on the Roosevelt. In calculating the tonnage the average thickness of the blocked ore was taken as 5 feet, the probable ore as 4 feet, and the possible ore as 3 feet. * * *
>
> Additional ore reserves are certain because it is more than probable that the carbonate ore shoot, passing below the 400 and 500 levels between 340 and 510 feet from the main shaft, will connect with the Silver or Roosevelt veins.
>
> Ore has been mined on the 1,000 level as indicated on the vertical section and is still going down, so additional ore will be available between the 1,000 and 1,100 levels.
>
> The most important new development in the mine has taken place in the 904 raise. This raise was started at the intersection of the Silver vein with the Roosevelt vein and is now up 130 feet in the Roosevelt vein in continuous ore. At the elevation of the 800 level drifting has shown an ore shoot 50 feet in length and its extent not proven. The Roosevelt vein strikes north 70° to 85° east and dips 60° to 65° south, and has a normal fault, down on the south side, of 350 feet. It will pass through our properties for 7,000 feet. * * *
>
> Other ore discoveries will probably be made on the East Crescent and other veins. * * *

The Park Galena Mining Co. operated its property 3 miles south of Keetley the entire year and shipped 4,772 tons of lead-zinc ore to Midvale for milling. The milling ore contained 550.83 ounces of gold, 65,091 ounces of silver, 48,051 pounds of copper, 1,456,437 pounds of lead, and 556,674 pounds of zinc, for which the company received $53,159. The output of ore and the production of all metals increased over 1929, when the company received $42,566 from the sale of 3,610 tons of ore. More than 600 feet of work was done in 1930, chiefly in drifting.

The Central Park Mines Co. was organized early in the year to operate the old American Flag mine at Park City, a producer of siliceous silver ore in the past and a producer of silver-lead-zinc ore as recently as 1924 and 1925. The company did about 2,000 feet of work in 1930 and shipped two cars of siliceous silver ore of smelting grade and two cars of lead-zinc ore of milling grade. The property was closed at the end of the year on account of low metal prices. About 3,500 feet of development was done at the Three Kings mine, and one car of first-class oxidized silver-lead ore was shipped to the lead plant of the International Smelting Co. Charles Moore continued to treat old tailings, containing chiefly zinc, obtained from creeks in Woodside Gulch below the Silver King Coalition mill and in Empire Canyon below the Judge mill; he treated several thousand tons in 1930. The resulting lead-zinc concentrates, containing a little gold, silver, and copper, were shipped to the custom flotation mill at Midvale to be re-treated. It is estimated that since 1921 these plants have treated more than 1,000,000 tons of old tailings, and that 355.45 ounces of gold, 146,289 ounces of silver, 91,769 pounds of copper, 2,138,395 pounds of lead, and 2,438,789 pounds of zinc have been recovered from concentrates. Several hundred tons of siliceous old tailings, containing chiefly silver and lead, obtained from creeks near Park City were shipped in 1930 to Garfield for smelting. Considerable development was done at several properties near Keetley in the eastern section of the Park City region in Wasatch County. The American Smelting & Refining Co. did 1,900 feet of drifting and 100 feet of work in a winze at the East Utah group, but operations were suspended in September. The Star of Utah Mining Co. did more than 2,400 feet of work at its property; considerable development was also done at the Park-Konold, Park Premier, Sphinx Silver-Lead, Park King, Mayflower, and Park Standard properties.

TOOELE COUNTY

In Tooele County 15 mines produced 45,726 tons of ore, a decrease of 16,904 tons from the output reported from 24 mines in 1929. The recovered gold decreased from $135,222 to $90,129, the silver from 387,441 to 305,969 fine ounces, the copper from 329,750 to 222,670 pounds, the lead from 23,599,238 to 20,660,980 pounds, and the zinc from 1,048,727 to 715,042 pounds. The total value of these metals decreased from $1,955,732 to $1,304,245. More than 97 per cent of the total ore of the county was produced from the properties of the Bluestone Lime & Quartzite Mining Co. and the Combined Metals Reduction Co. at Bauer. The largest producer in the county was the Bluestone Lime & Quartzite Mining Co., which increased its output of silver and lead but decreased that of gold and copper. The decrease in the metal output of the county was due chiefly to curtailment in shipments of silver-lead ore from the Honerine mine of the Combined Metals Reduction Co.

At International west of Bingham the International Smelting Co., a subsidiary of the Anaconda Copper Mining Co., continued to operate its 1,200-ton flotation mill on sulphide ore, its 150-ton oxide mill, and its copper and lead smelting plants on custom ore. The copper plant is equipped with 32 roasters, a Cottrell plant, 5 reverberatory furnaces, and 5 converters. The lead plant has 10 Dwight-Lloyd sintering machines and 5 blast furnaces, a bag house, and a drossing plant. Detailed descriptions of these plants were given in the Mines Handbook.[18] Receipts at both the copper and lead smelters were distinctly less in 1930 than in 1929.

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[18] Rand, L. H., and Sturgis, E. B., The Mines Handbook: Suffern, N. Y., vol. 18, 1931, p. 98.

The custom sulphide flotation plant at International treated about 196,000 tons of ore from Utah, Colorado, and Arizona, making lead concentrates, copper concentrates, and iron concentrates for treatment locally and zinc concentrates for shipment to Anaconda and Great Falls, Mont., and East St. Louis, Ill. The new flotation plant for oxidized ore treated about 46,800 tons of oxidized silver-lead ore from the Tintic district.

In 1930 the copper-smelting plant treated nearly 5 per cent less copper material than in 1929; most of the material came from Utah, California, Nevada, and Idaho. The lead plant received about 155,000 tons of ore and concentrates, chiefly from Utah and Nevada.

From 1917 to 1928 the smelting plants treated 1,458,146 tons of copper material and 2,672,680 tons of lead material from which 385,026 ounces of gold, 69,858,333 ounces of silver, 215,049,282 pounds of copper, and 963,531,515 pounds of lead were recovered, largely from Utah ores. Results for 1929 and 1930 are not given separately for the two smelting plants at International; but the Anaconda Copper Mining Co., in its annual report for 1930, states that the lead plant produced from custom ores 28,299.92 ounces of gold, 4,543,645 ounces of silver, and 107,860,121 pounds of lead. This output represents a large decrease from that reported for 1929, when the plant produced 38,163.64 ounces of gold, 6,356,611 ounces of silver, and 152,536,672 pounds of lead. The production from the copper plant was combined with the output of the copper plant of the International Smelting Co. at Miami, Ariz. The silver and copper in copper bullion from the Tooele copper plant were less in 1930 than in 1929, but there was an increase in the gold content.

Blue Bell district.—A small quantity of oxidized silver-lead ore of smelting grade was shipped from the Black Hawk claim of the R. E. Plough group, 11 miles southwest of Lofgreen.

Clifton district (*Gold Hill*).—Five lode mines in the Clifton district produced 1,009 tons of ore yielding $1,609 in gold, 3,704 ounces of silver, 47,885 pounds of copper, and 280,480 pounds of lead, valued in all at $23,284, or $23.08 in metals a ton. The output of each metal except gold increased, and the total value increased from $17,703 to $23,284. The entire output in 1930 was first-class smelting ore, half of which was oxidized lead ore from the Rube group; nearly all the remainder was oxidized copper ore, produced chiefly from the Frankie and Cane Springs mines near Gold Hill. No high-grade siliceous gold ore was produced from the gold claims of the Rube group, but the lead claims were operated continuously by lessees who shipped several hundred tons of first-class oxidized lead ore of smelting grade. The Frankie and Cane Springs properties, owned by the Woodman Estate, were also operated by lessees who shipped several hundred tons of oxidized copper ore to Garfield for smelting. Small quantities of ore, chiefly oxidized copper ore, were produced from the Copperopolis and Monocco mines. More activity was shown at properties near Gold Hill in 1930 than at any time during the past five years. The Garrison Monster mine, a producer of lead ore from 1924 to 1926, was operated in 1930 by lessees who did 260 feet of drifting and 40 feet of raising. No ore was shipped, but it was reported that considerable high-grade lead ore had been opened. Development was also done at the Christmas and Rube No. 3 claims.

Columbia district.—The Benmore Consolidated Mines Co. did practically no work at its property west of Lofgreen in 1930; a lessee, however, shipped several hundred tons of ferruginous manganese ore from the Victor claim to the Columbia Steel Co. plant near Provo.

Erickson district.—No ore was shipped from the Erickson district in 1930, but the Union Associated Mines Co. did 2,000 feet of drifting and tunneling at its property 40 miles north of Delta. The Copper Jack and Flying Dutchman property, a producer of copper ore in 1929, was practically idle in 1930.

Free Coinage district.—The Utah Bunker Hill Mining Co. owns a group of claims in the Stansbury Range 6 miles west of Grantsville. Development was continued most of the year, but no ore was marketed in 1930.

Lakeside district.—The American Smelting & Refining Co. did no work at the Monarch property in 1930; lessees, however, shipped two cars of oxidized lead ore of smelting grade. The Royal Ute Mining Co. reported 600 feet of development done at the Lead Prince property near Delle; and the Georgia Lyn mine, a producer of lead ore in 1929, was being further developed in 1930.

North Tintic district.—The Scranton mine near Topliff, a producer of zinc ore as recently as 1925 and of lead ore in 1926 and 1927, was again being operated in 1930; the shaft was sunk 200 feet, but no ore was mined.

Ophir district.—Four lode mines in the Ophir district produced 107 tons of ore yielding $309 in gold, 4,566 ounces of silver, 6,431 pounds of copper, and 36,180 pounds of lead, valued in all at $4,712, or $44.04 in metals a ton. The output of each of the four metals decreased from 1929, when 287 tons of ore yielded metals valued at $8,982. The Ophir-Mono Mines (Inc.) continued to operate the Mono property and shipped one car of first-class oxidized copper-lead ore of smelting grade. The Kearsarge Standard Mining Co. shipped two cars of oxidized silver-lead ore to a smelter, did 200 feet of drifting, and sank the inclined shaft an additional 150 feet. The American Smelting & Refining Co. worked the property of the Tintic Ophir Mines Co. under lease until May 15, when operations were suspended; the company did more than 1,600 feet of drifting and crosscutting, but no ore was shipped. A small quantity of oxidized silver-lead ore of smelting grade was shipped from the Buffalo mine, and a small lot of oxidized copper-lead ore was produced from the Queen of the Hills property. The Western Exploration Co. was organized in 1930 to operate the old Ophir Hill property, a large producer of silver, copper, and lead from 1900 to 1925. From October 23 to the end of the year the company did 800 feet of drifting and 250 feet of raising. The Fisk Ophir Mines Co. continued to develop its property and did about 1,000 feet of tunnel work during the year.

Rush Valley district (Stockton).—In 1930, as in 1929, the only two active mines in the Rush Valley district were the Honerine and Galena King groups of the Combined Metals Reduction Co. and the property of the Bluestone Lime & Quartzite Mining Co., both at Bauer. These mines produced 44,561 tons of ore yielding $88,207 in gold, 297,327 ounces of silver, 168,269 pounds of copper, 20,313,260 pounds of lead, and 715,042 pounds of zinc, valued in all at $1,274,538, or $28.60 in metals a ton. The output of ore and the production of all five metals decreased considerably from 1929, when 61,662 tons of ore yielded metals valued at $1,923,546. The largest decrease was in the output of silver-lead ore from the Honerine mine. The output of sulphide lead ore of smelting grade from the property of the Bluestone Lime & Quartzite Mining Co. decreased slightly, from 29,100 to 28,518 tons, but the production of silver and lead increased. The production of silver increased from 204,777 to 235,241 ounces and that of lead from 15,931,848 to 16,888,375 pounds; gold decreased from 4,591 to 3,979 ounces and copper from 230,615 to 166,204 pounds. The property ranked fifth in Utah in 1930 in production of lead, tenth in gold, and fourteenth in silver. It is opened by an inclined shaft 1,400 feet deep; development in 1930 consisted of 3,120 feet of drifting and crosscutting, 390 feet of raising, and 435 feet in the winzes. The company paid $300,000 in dividends in 1930 and a similar amount in 1929, or a total of $600,000 for the two years.

The Combined Metals Reduction Co. continued to operate the Honerine and Galena King groups. About 5,500 tons of first-class silver-lead ore were shipped to International for smelting, about 10,200 tons of lead-zinc ore were treated at the flotation plant of the Combined Metals Reduction Co. at Bauer, and about 1,000 tons of silver-lead ore were concentrated in the jigging plant close to the Bauer flotation mill. According to a report to the industrial commission the metal output in 1930 was less than half that in 1929; it consisted of 15,780 tons of first-class ore and mill ore containing 456 ounces of gold, 71,667 ounces of silver, 4,558,575 pounds of lead, and 1,126,462 pounds of zinc. The actual production of zinc was less than that shown here, as this figure includes the zinc content of lead ore smelted at International. The output of silver-lead ore of smelting grade from the Honerine mine was only about one-third that in 1929, but the output of lead-zinc mill ore was more than in 1929. In 1930 more than 7,200 feet of work was done in drifts, raises, and winzes. In addition to being a large producer of gold and silver the company ranked eighth in Utah in 1930 in production of zinc and ninth in lead.

The flotation plant at Bauer was operated the entire year and treated nearly 139,000 tons of lead-zinc ore from Utah, Nevada, Idaho, and Colorado. Lead concentrates from the plant were shipped to the International smelter near Tooele, Utah, and the zinc product was shipped to Anaconda and Great Falls, Mont., and East St. Louis, Ill. The milling work at Bauer has been distinctly successful although the leaching end of the process was not used.

Silver Islet district.—There was no output from the Silver Islet district in 1930. The Silver Glance Mining Co., owning property 14 miles east of Wendover, which produced high-grade silver ore in 1929, was idle in 1930.

UINTAH COUNTY

No production of metals was reported from properties in Uintah County in 1930. The Dyer mine near Vernal, a producer of copper ore in 1929 and in early years, was idle in 1930. It had been idle from 1904 to 1928.

UTAH COUNTY

The value of the mine production of metals in Utah County decreased from $7,407,899 in 1929 to $5,241,996 in 1930 but was greater than that of any county in the State, except Salt Lake County. The large increase of more than $633,000 in output of gold was due chiefly to the increase in shipments of siliceous gold ore from the North Lily and Eureka Standard mines near Dividend in the eastern section of the Tintic district. There was, however, a decrease of more than 21,000,000 pounds in the output of lead as a result of curtailment in shipments of silver-lead ore from the North Lily and Tintic Standard mines; the output of silver, copper, and zinc also decreased.

Mine production of gold, silver, copper, lead, and zinc in American Fork district, Utah, 1929 and 1930, and total, 1870–1930, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	3	5, 737	$34, 270	18, 458	70, 563	383, 032	----------	$80, 658
1930	2	252	2, 446	1, 291	8, 639	19, 260	----------	5, 029
Total, 1870–1930	-------	99, 567	552, 073	2, 049, 927	1, 029, 936	31, 912, 036	313, 926	4, 679, 528

American Fork district.—The Live Yankee mine of the American Smelting & Refining Co. was the only important producer in the American Fork district in 1930. The output of 220 tons of first-class sulphide copper ore was a marked decrease from 1,148 tons of first-class smelting ore and concentrates shipped in 1929. No concentrates were produced in 1930, as the 50-ton plant equipped with jigs and tables was inactive. The smelting ore contained 118.35 ounces of gold, 893 ounces of silver, 8,774 pounds of copper, and 3,670 pounds of lead, for which the company received $2,115. The predominant minerals are pyrite and chalcopyrite, but the ore is valuable chiefly for the gold it contains; the crude smelting ore shipped in 1930 averaged nearly 0.54 ounce of gold to the ton. The mine is opened by a tunnel 1,800 feet long; about 2,800 feet of work was done in 1930. The only other producer in the American Fork district in 1930 was the Blue Rock property owned by the Pacific Gold Mining & Milling Co. The mine was idle during the entire year, but lessees shipped one car of silver-lead ore of smelting grade from the dump.

North Tintic district.—The Lehi Tintic Mining Co. did considerable work at its property adjoining the Tintic Paymaster mine and shipped one car of oxidized lead ore of smelting grade.

Tintic district.—The following mines, which are in Utah County in the eastern part of the Tintic district, are mentioned in the general review under Juab County: Tintic Standard, North Lily, Eureka Standard, Eureka Lilly, Mountain View (May Day), Iron King, Colorado Consolidated, Yankee Consolidated, Utah Consolidated, Eureka Bullion, and Tintic Bullion.

WASHINGTON COUNTY

Bull Valley (Gold Strike) district.—The Hamburg group 30 miles south of Modena, which produced a small quantity of high-grade gold ore in 1929, was idle in 1930.

Harrisburg district.—The American Smelting & Refining Co. suspended operations at the Silver Reef property, after intensive development in 1928 and 1929 failed to open commercial ore bodies.

Tutsagubet district.—Lessees continued to operate the Dixie (Apex) mine near St. George in 1930 and shipped 750 tons of first-class oxidized ore containing more than 31 per cent of copper. The ore, which contains azurite, malachite, cuprite, and native copper, is hauled 80 miles north to Cedar City, the nearest shipping point on the Los Angeles & Salt Lake Railroad. The mine is developed by a vertical shaft 600 feet deep from a tunnel 850 feet long and by 10,000 feet of drifts; development in 1930 consisted of 200 feet of drifting and 100 feet of work in the winze.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO [1]

(MINE REPORT)

By C. N. GERRY and T. H. MILLER [2]

CONTENTS

	Page
Summary	611
Mining industry	618
Ore classification	619
Metallurgic industry	624
Review by counties and districts	632
Ada County	632
Adams County	632
Bear Lake County	632
Blaine County	632
Boise County	633
Bonner County	635
Bonneville County	635
Boundary County	636
Butte County	636
Camas County	636
Cassia County	636
Review by counties and districts—Continued.	
Clark County	637
Clearwater County	637
Custer County	637
Elmore County	638
Gem County	638
Idaho County	639
Kootenai County	640
Latah County	640
Lemhi County	641
Owyhee County	642
Shoshone County	643
Coeur d'Alene region	643
Twin Falls County	659
Valley County	660
Washington County	660

SUMMARY

The value of the mine production of gold, silver, copper, lead, and zinc in Idaho decreased from $31,104,246 in 1929 to $21,494,867 in 1930, and the quantity of each of these metals except gold and silver decreased decidedly. The output of lead decreased more than 29,000,000 pounds, and the output of zinc and copper also decreased considerably. The general decrease in the base metals was due chiefly to the drop in the average prices. The output of silver was upheld by the vigorous work of one of the leading mines of the State despite the marked decline in the average price of silver. The total value of the metal output of Idaho in 1930 was less than that in any year since 1922 and less than the average annual value for the decade 1921 to 1930, which was $25,637,218. Since 1863 Idaho's output of the five metals has been as follows: Gold, $137,510,199; silver, 326,448,018 fine ounces; copper, 157,372,674 pounds; lead, 9,067,817,249 pounds; and zinc, 844,326,651 pounds. The total value has amounted to $960,002,033, more than half of which represents the value of the lead. The value of the metal output of Idaho from the early days of mining is by no means as large as that of Arizona, California, Colorado, Montana, or Utah. In 1930, however, Idaho was second in silver output after Utah, second in lead output after Missouri, and fifth in zinc output after Oklahoma, New Jersey, Kansas, and Utah. Dividends for 1930, taken largely from the annual printed reports of the companies, amounted to about $3,700,000. It is impossible to give the exact total, as part of the dividend disbursement is paid from operations in other States, and the small amount paid by certain lessees is not published in the mining journals or on the mine schedules.

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[1] Work on manuscript completed October, 1931.

[2] The assistance of Paul Luff and LaRu Shepherd, of the Bureau of Mines, is appreciated.

Although the metal output of Idaho in 1930 was derived from 19 counties, most of the silver, lead, and zinc and half of the copper were recovered from ore and concentrates from Shoshone County (the famous Coeur d'Alene region), whose metal output was valued at $19,728,887, a decrease of $8,710,464 from that in 1929. Blaine, Valley, Boise, and Custer Counties followed in order, but Blaine County was the only one of these counties to attain an output valued at more than $500,000 in 1930.

Tables printed in Mineral Resources for 1922 and subsequent years give the source of the different metals by kinds of ore and by years from 1911 to 1929. During the decade 1921 to 1930, 45.77 per cent of the gold was derived from placers and 37.6 per cent from dry and siliceous ore; 64.3 per cent of the silver and 73.45 per cent of the lead came from lead ore; and most of the remainder of the silver and lead came from lead-zinc ore and copper-lead ore. It is interesting to note that as the silver from lead ore is gradually decreasing, that from copper-lead ore, largely from the Sunshine mine, is distinctly increasing. In 1930, 66 per cent of the total gold produced was derived from dry gold ore; more than 18 per cent came from placers; and most of the remainder came from lead-zinc ore, lead ore, and copper ore. More than 47 per cent of the silver and nearly 65 per cent of the lead came from lead ore; nearly all the remainder of the silver came from copper-lead ore and lead-zinc ore; and nearly all the remainder of the lead came from lead-zinc ore. In 1930 more gold was produced from dry gold ore than in any year of the last decade.

The report[3] of the mine inspector of Idaho contains notes on the progress of the mining industry, lists the active producing and developing companies by counties, includes accident statistics, and gives an interesting bibliography for each county. The inspector estimates that 4,800 men were employed in Idaho mines in 1930.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[3] Campbell, Stewart, Thirty-Second Annual Report of the Mining Industry of Idaho, for 1930, 308 pp.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	133	92	1, 514, 447	26, 399. 73	$545, 731	6, 080, 528	$6, 080, 528
1922	154	94	1, 436, 884	24, 255. 46	501, 405	6, 081, 865	6, 081, 865
1923	146	85	1, 763, 520	37, 124. 28	767, 427	7, 673, 662	6, 292, 403
1924	141	79	1, 711, 988	26, 921. 80	556, 523	7, 793, 154	5, 221, 413
1925	190	85	1, 827, 715	20, 886. 92	431, 771	7, 743, 439	5, 373, 947
1926	177	69	1, 934, 143	13, 669. 27	282, 569	7, 556, 444	4, 715, 221
1927	148	70	2, 018, 325	15, 315. 67	316, 603	8, 901, 409	5, 047, 099
1928	151	56	2, 054, 329	20, 980. 38	433, 703	8, 998, 330	5, 264, 023
1929	147	51	2, 174, 125	20, 247. 11	418, 545	9, 414, 403	5, 017, 877
1930	131	61	1, 944, 900	21, 445. 07	443, 309	9, 420, 639	3, 626, 946

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	1, 688, 195	$217, 777	198, 469, 119	$8, 931, 110	33, 463	$1, 673	$15, 776, 819
1922	3, 282, 842	443, 184	195, 834, 205	10, 770, 881	4, 109, 131	234, 220	18, 031, 555
1923	3, 979, 631	585, 006	242, 355, 733	16, 964, 901	27, 952, 749	1, 900, 787	26, 510, 524
1924	2, 738, 824	358, 786	248, 950, 292	19, 916, 023	15, 340, 498	997, 132	27, 049, 877
1925	3, 297, 443	468, 237	253, 041, 790	22, 014, 636	31, 237, 240	2, 374, 030	30, 662, 621
1926	1, 337, 442	187, 242	272, 980, 212	21, 838, 417	52, 614, 691	3, 946, 102	30, 969, 551
1927	2, 173, 163	284, 684	302, 038, 423	19, 028, 421	53, 556, 345	3, 427, 606	28, 104, 413
1928	2, 072, 165	298, 392	290, 645, 905	16, 857, 462	62, 526, 648	3, 814, 126	26, 667, 706
1929	5, 131, 438	903, 133	297, 389, 488	18, 735, 538	91, 350, 807	6, 029, 153	31, 104, 246
1930	3, 111, 555	404, 502	268, 115, 963	13, 405, 798	75, 298, 172	3, 614, 312	21, 494, 867

Gold and silver produced at placer mines in Idaho, 1921–1930

Year	Gold		Silver		Year	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value		Fine ounces	Value	Fine ounces	Value
1921	8, 784. 90	$181, 600	1, 686	$1, 686	1926	8, 360. 45	$172, 826	2, 029	$1, 266
1922	8, 899. 64	183, 972	1, 959	1, 959	1927	7, 520. 33	155, 459	2, 306	1, 308
1923	24, 125. 05	498, 709	6, 616	5, 425	1928	8, 191. 63	169, 336	2, 538	1, 485
1924	17, 324. 10	358, 121	4, 248	2, 846	1929	4, 129. 92	85, 373	1, 419	756
1925	12, 692. 92	262, 386	2, 812	1, 952	1930	3, 987. 45	82, 428	1, 355	522

GOLD

The production of gold in Idaho in 1930 was $443,309, an increase of nearly 6 per cent over that in 1929 but less than the average annual output ($469,759) for the decade 1921 to 1930. The increase was due chiefly to the operation of the new mill of the Sherman Howe

Mining Co. (Inc.) near Burgdorf, Idaho County, and to the increase in the production of gold from the Gold Hill & Iowa mine at Quartzburg, Boise County. There was also a substantial increase in the production of gold from the Lost Pilgrim & Hall-Interstate group near Cascade, Valley County, operated by the Bunker Hill & Sullivan Mining & Concentrating Co., but the gold output from the Idawa property in Boise County continued to decrease. In 1930 gold from lode mines increased, especially that from the Sherman Howe and Gold Hill & Iowa mines, but gold from placer mines decreased slightly. More than 66 per cent of the State's output of gold in 1930 was produced from the Gold Hill & Iowa, Idawa, Sherman Howe, and Idaho Gold Dredging properties. Lode mines yielded $360,881 in gold in 1930, an increase of 8 per cent over 1929, and placers yielded $82,428. Of the placer output $68,527 was won by dredges, an increase of $8,384 over the dredge output in 1929. Since 1897 gold worth $6,155,602 has been recovered by dredges. Gold from gold ore as well as that from lead ore and lead-zinc ore increased decidedly in 1930, but a decrease was recorded in gold from copper ore. The production of gold from mills using amalgamation was 12,615.21 ounces, nearly 59 per cent of the total gold output in 1930 and an increase from 11,634.13 ounces in 1929. Concentrates of all kinds yielded 19 per cent of the total gold, crude ore shipped for smelting yielded nearly 4 per cent, and placers yielded more than 18 per cent.

In 1930 four mines had a gold output of more than $49,000 each—those of the Talache Mines (Inc.) (Gold Hill & Iowa mine) at Quartzburg, the Idawa Gold Mining Co. at Placerville, the Sherman Howe Mining Co. (Inc.) near Burgdorf, and the Idaho Gold Dredging Corporation at Centerville. Other large producers of gold were the Lost Pilgrim & Hall-Interstate group near Cascade, the Mackay Metals (Inc.) at White Knob, the American Gold Dredging Corporation at Triangle, the Mineral Mining Co. at Placerville, and the Lone Pine mine at Golden.

SILVER

The production of silver in Idaho in 1930 was 9,420,639 ounces, the largest output since 1917, when a total of 12,029,338 ounces was produced; it was decidedly more than the yearly average for the decade 1921 to 1930, which was about 7,966,400 ounces. Compared with other large producing States Idaho produced more silver than Montana, Arizona, Colorado, or Nevada, but less than Utah. The output of silver in Shoshone County increased 54,735 ounces. Increases in Valley, Blaine, and Boise Counties were also good, but the output from Custer, Butte, and Lemhi Counties was much smaller than in 1929. The increase in silver was due chiefly to the decided increase in shipments of copper-lead concentrates rich in silver from the Sunshine mine in Shoshone County. The Lost Pilgrim & Hall-Interstate group, Page, Blackhawk, Constitution, Frisco, Triumph, and Whitedelf mines also made good increases in silver output, and a large output of silver was made from the old tailings dump at Kellogg. The output of most of the larger producers of silver, however, decreased.

Concentrates yielded more than 93 per cent of the total silver, crude smelting ore more than 6.5 per cent, and placer bullion and gold and silver bullion from lode mines less than one-tenth of 1 per cent. The Sunshine property became the largest producer of silver and was followed by the Bunker Hill & Sullivan, Hecla, and Morning mines;

each of these properties yielded more than 1,000,000 ounces of silver. These four properties produced more than 73 per cent of the State's output of silver. Other large producers of silver were the Crescent, Page, Dayrock, Sherman, Lost Pilgrim & Hall-Interstate, Gold Hunter, and Triumph mines. The spectacular feature of 1930 was the fact that Idaho increased its output of silver when there was a marked decrease in the silver output of other Western States.

COPPER

The production of copper in Idaho in 1930 was 3,111,555 pounds, a decrease of more than 39 per cent from the output in 1929 but more than the average yearly output (about 2,881,200 pounds) for the decade 1921 to 1930. The decrease was due to the drop in the average price of copper from 17.6 cents a pound in 1929 to 13 cents a pound in 1930. The production of copper in Custer County decreased from 2,837,398 pounds in 1929 to 1,128,465 pounds in 1930 as a result of the decreased output of the Mackay Metals (Inc.). The Winder-Stillman Con and the Harmony Mines Co., both operating mines in Lemhi County, decreased their output of copper considerably. Increases in copper, however, were made by the Bunker Hill & Sullivan, Lost Pilgrim & Hall-Interstate, Sunshine, and Morning mines. Concentrates of all kinds yielded 92 per cent of the total copper and crude smelting ore 8 per cent. The largest producers of copper in the State in 1930 were the Mackay Metals (Inc.) near Mackay, Custer County; the Sunshine, Bunker Hill & Sullivan, and Hecla mines in Shoshone County; the Winder-Stillman Con (Pope-Shenon mine) near Salmon, Lemhi County; the Morning mine in Shoshone County; and the Lost Pilgrim & Hall-Interstate group near Cascade, Valley County.

LEAD

The production of lead in Idaho in 1930 decreased nearly 10 per cent in quantity from the output in 1929, but it was much more than the average annual output (256,982,113 pounds) for the decade 1921 to 1930. The decrease was due chiefly to the decline in the average price of lead from 6.3 cents a pound in 1929 to 5 cents a pound in 1930, which resulted in curtailment of production by nearly all the larger producers of lead. The output of lead from the Tamarack & Custer, Morning, Star, Golconda, Livingston, Wilbert, Hunter, Sherman, Sidney, and Page mines and from the property of the Jack Waite Mining Co. in Idaho decreased considerably; but that from the Bunker Hill & Sullivan, Blackhawk, Lost Pilgrim & Hall-Interstate, Constitution, Frisco, Whitedelf, and Triumph mines increased. The output from the Hecla and Dayrock mines decreased slightly, but a large quantity of lead was produced from the old tailings dump at Kellogg. Shoshone County supplied more than 96 per cent of the total lead; Blaine, Bonner, Butte, and Valley Counties also made good production. Concentrates of all kinds yielded 92 per cent of the total lead and crude smelting ore 8 per cent.

Twelve mines produced more than 3,000,000 pounds of lead each in 1930. Three of them—the Bunker Hill & Sullivan, Morning, and Hecla—yielded more than 55,000,000 pounds each; together they produced 75 per cent of the State's output of lead. The other large producers were the Page, Dayrock, Sherman, Gold Hunter, and Blackhawk mines; an old tailings dump near Kellogg; and the Jack Waite, Triumph, and Star mines. All these properties are in Shoshone County except the Triumph mine near Hailey, Blaine County.

ZINC

The production of zinc in Idaho in 1930 amounted to 75,298,172 pounds, a decrease of nearly 18 per cent from the record output in 1929 but decidedly more than the yearly average output (41,401,974 pounds) for the decade 1921 to 1930. The decrease was due chiefly to the decline in the average price of zinc from 6.6 cents a pound in 1929 to 4.8 cents a pound in 1930, which resulted in curtailment by most of the large producers of zinc. The Morning mine, however, increased its production nearly 2 per cent over that in 1929 and produced 49 per cent of the State's output of zinc. Good increases in output of zinc were also made by the Bunker Hill & Sullivan, Constitution, Lost Pilgrim & Hall-Interstate, and Triumph mines; but decided decreases were recorded in the output from the Star, Tamarack & Custer, Sidney, Golconda, and Frisco mines. All the zinc concentrates, except those from Blaine, Butte, Camas, and Valley Counties, came from the Coeur d'Alene region where the largest producers of zinc were the Morning, Bunker Hill & Sullivan, Sidney, Star, Constitution, Frisco, Tamarack & Custer, Page, Golconda, and Hecla mines. The Triumph mine near Hailey, Blaine County, ranked second as a producer of zinc in Idaho in 1930; and the Lost Pilgrim & Hall-Interstate group near Cascade, Valley County, ranked eighth. Ore that was not milled locally was shipped to custom milling plants at Bauer and Midvale, Utah. The resulting zinc products were treated at the electrolytic zinc plants at Anaconda and Great Falls, Mont., and at the new electrolytic plant of the Sullivan Mining Co., at Silver King, Idaho.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1930, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Ada	0.34	$7	21.72	$449	$456	16	$6
Blaine	163.12	3,372			3,372	199,203	76,693
Boise	10,481.56	216,673	2,777.69	57,420	274,093	22,932	8,829
Bonner	1.02	21			21	86,110	33,152
Bonneville			11.61	240	240		
Butte	3.19	66			66	19,734	7,598
Camas	46.78	967			967	258	99
Clark						39	15
Clearwater			45.23	935	935	4	2
Custer	926.81	19,159	8.13	168	19,327	49,823	19,182
Elmore	9.05	187	45.23	935	1,122	19	7
Gem			7.64	158	158		
Idaho	3,632.77	75,096	153.40	3,171	78,267	9,276	3,571
Lemhi	450.27	9,308	144.16	2,980	12,288	5,206	2,004
Owyhee	249.13	5,150	660.32	13,650	18,800	6,332	2,438
Shoshone	494.54	10,223	68.93	1,425	11,648	8,831,461	3,400,113
Twin Falls			7.74	160	160		
Valley	918.74	18,992	35.65	737	19,729	188,351	72,515
Washington	80.30	1,660			1,660	1,875	722
	17,457.62	360,881	3,987.15	82,428	443,309	9,420,639	3,626,946
Total, 1929	16,117.19	333,172	4,129.92	85,373	418,545	9,414,403	5,017,877

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1930, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Ada							$462
Blaine	34, 220	$4, 449	3, 597, 273	$179, 864	6, 146, 421	$295, 028	559, 406
Boise	2, 892	376	111, 521	5, 576			288, 874
Bonner	2, 265	294	1, 913, 622	95, 681			129, 148
Bonneville							240
Butte	2, 874	374	1, 671, 287	83, 564	1, 567	75	91, 677
Camas	266	35	8, 145	407	4, 234	203	1, 711
Clark			13, 971	699			714
Clearwater							937
Custer	1, 128, 465	146, 700	382, 182	19, 109			204, 318
Elmore							1, 129
Gem							158
Idaho	1, 295	168	795	40			82, 046
Lemhi	256, 728	33, 375	318, 423	15, 921			63, 588
Owyhee	33	4					21, 242
Shoshone	1, 569, 882	204, 085	258, 621, 960	12, 931, 098	66, 290, 478	3, 181, 943	19, 728, 887
Twin Falls							160
Valley	110, 140	14, 318	1, 457, 180	72, 859	2, 855, 472	137, 063	316, 484
Washington	2, 495	324	19, 604	980			3, 686
	3, 111, 555	404, 502	268, 115, 963	13, 405, 798	75, 298, 172	3, 614, 312	21, 494, 867
Total, 1929	5, 131, 438	903, 133	297, 389, 488	18, 735, 538	91, 350, 807	6, 029, 153	31, 104, 246

Ore, old tailings, etc., sold or treated, lode mines producing, and average value of ore etc., in gold and silver in Idaho, 1929 and 1930, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Ada	13	1	2	1	$36. 31	$10. 00
Adams	42		1		6. 57	
Bear Lake	89		1		1. 21	
Blaine	26, 838	25, 949	20	10	3. 77	3. 09
Boise	21, 782	25, 480	8	13	9. 70	8. 84
Bonner	11, 945	19, 202	7	3	4. 06	1. 73
Boundary	16		1		2. 75	
Butte	14, 412	8, 437	2	5	2. 09	. 91
Camas	56	75	2	3	16. 55	14. 21
Clark	13	22	1	1	2. 00	. 68
Custer	92, 405	27, 671	11	7	1. 98	1. 39
Elmore	17	24	4	2	30. 76	7. 83
Gem	300		2		5. 14	
Idaho	2, 898	8, 293	6	14	15. 11	9. 48
Latah	44		1		. 89	
Lemhi	27, 551	8, 420	21	16	. 53	1. 34
Owyhee	202	354	9	12	48. 00	21. 09
Shoshone	1, 971, 580	1, 794, 929	44	38	2. 38	1. 90
Valley	3, 729	25, 679	2	3	3. 71	3. 56
Washington	193	364	2	3	14. 57	6. 54
	2, 174, 125	1, 944, 900	147	131	2. 46	2. 05

Gold and silver produced at placer mines in Idaho in 1930, by counties

County	Mines		Gold	Silver (fine ounces)	Total value
	Dredge	Hydraulic and sluicing			
Ada		2	$449	7	$452
Boise	2	5	57,420	952	57,787
Bonneville		1	240		240
Clearwater		6	935	4	937
Custer		3	168	3	169
Elmore		6	935	16	941
Gem		1	158		158
Idaho		18	3,171	26	3,181
Lemhi		8	2,980	14	2,985
Owyhee	1		13,650	318	13,772
Shoshone		4	1,425	10	1,429
Twin Falls		2	160		160
Valley		2	737	5	739
	3	58	82,428	1,355	82,950
Total, 1929	3	48	85,373	1,419	86,129

MINING INDUSTRY

The general condition of the mining industry in Idaho in 1930 was similar to that prevailing in other western mining States. The value of the mine output in Idaho declined about 31 per cent from that in 1929, compared with declines of 48 per cent in Arizona, 49 per cent in Utah, and 54 per cent in Montana. It is evident that in Idaho the mining industry reacted to the general business depression but to a smaller extent than in the other States mentioned, due chiefly to the fact that the Idaho metal output is valuable chiefly for its lead and silver and is less dependent upon the price of copper.

Many of the larger producing mines, including the Star, Gold Hunter, Golconda, Sherman, Tamarack & Custer, Sidney, and Constitution, were closed during the earlier part of the year, and curtailment was in effect at other large mines, including the Morning and Hecla. In striking contrast to the general curtailment, the Sunshine Mining Co. reported a large increase in the output of silver and the Bunker Hill & Sullivan Mining & Concentrating Co. maintained normal production throughout the year. Active mine development was reported by nearly all the larger mines throughout the year; and increased ore reserves were reported at the Bunker Hill & Sullivan, Morning, Hecla, Sunshine, Sherman, Jack Waite, Sidney, Galena, Constitution, Dayrock, Talache, and Lost Pilgrim & Hall-Interstate mines.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Idaho, 1921–1930, with content in terms of recovered metals

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
DRY AND SILICEOUS ORE						
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	48, 221	13, 826. 54	49, 034	7, 084	16, 942	
1922	25, 766	9, 084. 94	91, 377	19, 252	25, 995	
1923	24, 059	6, 570. 14	67, 294	5, 535	29, 719	
1924	19, 260	5, 808. 43	47, 137	1, 159	3, 086	
1925	18, 135	4, 054. 53	124, 911	51, 041	235, 762	
1926	5, 862	2, 995. 17	24, 335	3, 852	7, 495	
1927	5, 268	4, 823. 28	23, 420	3, 192	7, 992	
1928	10, 571	11, 195. 84	29, 203	5, 966	15, 162	
1929	26, 583	12, 830. 06	30, 450	2, 575	16, 692	
1930	33, 259	14, 242. 78	35, 737	3, 969	17, 647	
COPPER ORE						
1921	10, 322	1, 258. 62	23, 987	1, 105, 511		
1922	32, 590	2, 045. 78	44, 550	2, 572, 335	707	
1923	41, 901	1, 516. 80	74, 247	2, 794, 091	3, 517	
1924	37, 634	2, 407. 47	504, 644	1, 989, 050	131, 204	
1925	51, 004	2, 785. 20	711, 874	2, 738, 861	33, 678	
1926	28, 258	431. 64	429, 343	586, 387	42, 512	
1927	27, 742	794. 38	49, 623	1, 030, 348	7, 000	
1928	31, 454	559. 38	262, 938	1, 058, 944	39, 833	
1929	91, 782	2, 371. 41	68, 410	3, 777, 080	3, 000	
1930	33, 129	810. 36	26, 262	1, 379, 869		
LEAD ORE						
1921	1, 446, 710	2, 467. 70	5, 688, 577	449, 883	198, 322, 374	
1922	1, 331, 785	2, 590. 10	5, 450, 038	399, 160	193, 551, 305	1, 699, 261
1923	1, 192, 442	2, 066. 00	5, 489, 477	594, 748	191, 685, 757	
1924	1, 254, 212	1, 061. 00	5, 815, 764	672, 154	201, 074, 111	151, 453
1925	1, 088, 564	1, 048. 63	4, 791, 497	272, 978	175, 631, 005	
1926	1, 084, 345	1, 455. 74	4, 575, 490	430, 937	183, 074, 616	
1927	1, 308, 987	1, 828. 47	5, 609, 605	735, 175	220, 178, 217	235, 768
1928	1, 138, 581	487. 92	4, 623, 567	443, 604	173, 763, 525	1, 427, 429
1929	1, 021, 203	233. 34	4, 706, 508	458, 894	177, 031, 191	4, 073, 416
1930	1, 051, 962	1, 073. 79	4, 462, 368	736, 994	173, 263, 711	6, 689, 544
COPPER-LEAD ORE						
1921	9, 122	61. 97	317, 244	125, 717	129, 803	
1922	26, 143	1, 635. 00	459, 529	292, 095	333, 045	
1923	52, 291	2, 587. 09	917, 215	546, 343	1, 167, 818	
1924	3, 962	12. 21	140, 423	53, 387	536, 356	
1925	6, 275	26. 31	230, 584	90, 477	1, 233, 092	
1926	22, 037	33. 98	445, 520	116, 124	717, 352	
1927	40, 125	1. 12	1, 079, 747	264, 399	1, 316, 757	
1928	49, 273	. 46	1, 146, 294	176, 210	1, 345, 312	
1929	84, 138	6. 48	2, 017, 528	379, 062	1, 960, 613	
1930	161, 863		2, 635, 993	491, 468	1, 713, 147	
ZINC ORE, COPPER-LEAD-ZINC ORE, COPPER-ZINC ORE, AND LEAD-ZINC ORE						
1921	72					33, 463
1922	20, 600		34, 412		1, 923, 153	2, 409, 870
1923	452, 827	259. 20	1, 118, 813	38, 914	49, 468, 922	27, 952, 749
1924	396, 920	308. 59	1, 280, 938	23, 074	47, 205, 535	15, 189, 045
1925	663, 737	279. 33	1, 881, 761	144, 086	75, 908, 253	31, 237, 240
1926	793, 641	392. 29	2, 079, 727	200, 142	89, 138, 237	52, 614, 691
1927	636, 203	348. 09	2, 136, 708	140, 049	80, 528, 457	53, 320, 577
1928	824, 450	545. 15	2, 933, 790	387, 441	115, 482, 073	61, 099, 219
1929	950, 419	675. 90	2, 590, 088	513, 827	118, 377, 992	87, 277, 391
1930	664, 687	1, 330. 69	2, 258, 924	499, 255	93, 121, 458	68, 608, 628

Ore, old tailings, etc., sold or treated in Idaho in 1930, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	47	[1] 32,420	14,179.62	25,075	2,399	9,617	
Dry gold and silver ore	2	2	2.11	86			
Dry silver ore	7	[2] 837	61.05	10,576	1,570	8,030	
Copper ore	9	33,129	810.36	26,262	1,379,869		
Lead ore	53	[3] 1,051,962	1,073.79	4,462,368	736,994	173,263,711	6,689,544
Zinc ore	1	[4] 807		800		11,700	100,268
Copper-lead ore	3	161,863		2,635,993	491,468	1,713,147	
Lead-zinc ore	19	663,880	1,330.69	2,258,124	499,255	93,109,758	68,508,360
Total, lode mines	[5] 131	1,944,900	17,457.62	9,419,284	3,111,555	268,115,963	75,298,172
Total, placers	61		3,987.45	1,355			
	192	1,944,900	21,445.07	9,420,639	3,111,555	268,115,963	75,298,172
Total, 1929	198	2,174,125	20,247.11	9,414,403	5,131,438	297,389,488	91,350,807

[1] Includes 28 tons of old mill cleanings treated by amalgamation.
[2] Includes 100 tons of old tailings treated by cyanidation.
[3] Includes 114,387 tons of old tailings concentrated.
[4] Old tailings concentrated.
[5] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Value of metals from ore, old tailings, etc., sold or treated in Idaho in 1930, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	32,420	$293,119	$9,654	$312	$481		$303,566
Dry gold and silver ore	2	43	33				76
Dry silver ore	837	1,262	4,072	204	401		5,939
Copper ore	33,129	16,752	10,111	179,383			206,246
Lead ore	1,051,962	22,197	1,718,011	95,809	8,663,186	$321,098	10,820,301
Zinc ore	807		308		585	4,813	5,706
Copper-lead ore	161,863		1,014,857	63,891	85,657		1,164,405
Lead-zinc ore	663,880	27,508	869,378	64,903	4,655,488	3,288,401	8,905,678
	1,944,900	360,881	3,626,424	404,502	13,405,798	3,614,312	21,411,917
Total, 1929	2,174,125	333,172	5,017,121	903,133	18,735,538	6,029,153	31,018,117

GOLD ORE

The output of gold ore from 47 mines in Idaho in 1930 was 22 per cent greater than that reported from 37 mines in 1929. The increase was due chiefly to the operation of the new mill of the Sherman Howe Mining Co. (Inc.) near Burgdorf, Idaho County. Nearly 91 per cent of the ore was produced from three mines in Boise and Idaho Counties—the Gold Hill & Iowa mine near Quartzburg and the Idawa mine near Placerville, both in Boise County, and the Sherman Howe mine near Burgdorf, in Idaho County. The Sunnyside Mining & Milling Co. near Cascade, Valley County, the Lone Pine mine at Golden, Idaho County, and the Unity Gold Mines Co. at Warren, Idaho County, also produced considerable gold ore. The ore, etc., yielded $9.04 in gold and 0.77 ounce of silver to the ton and a small quantity of copper and lead.

GOLD AND SILVER ORE

Two small lots of gold and silver ore were produced—one from a property near Stanley, Custer County, and the other from a claim near Silver City, Owyhee County. The ore had a total value of $76 in gold and silver.

SILVER ORE

Small lots of silver ore were mined in 1930 from properties near Bayview, Howe, and Silver City, but most of the silver ore came from the Native Missourian mine at Pioneerville, Boise County; some silver old tailings from a dump near Grandview were cyanided. The total silver ore and old tailings produced yielded $1.51 in gold and 12.636 ounces of silver to the ton and a small quantity of copper and lead.

COPPER ORE

The output of copper ore from 9 mines in Idaho in 1930 was a little more than one-third that reported from 11 mines in 1929. The marked decrease was due to the drop in the price of copper, which caused the Mackay Metals (Inc.), the chief copper producer in Idaho, to decrease its output decidedly. In 1930 the company produced 79 per cent of the State's output of copper ore, and nearly all the remainder came from the Pope-Shenon and Harmony mines in Lemhi County. More than 93 per cent of the total copper ore was concentrated. The average recovered content of the copper ore shipped or treated in 1930 was 50.57 cents in gold and 0.79 ounce of silver to the ton and 2.08 per cent of copper.

LEAD ORE

Except in 1929, lead ore has been the most valuable mine product of Idaho from the time the Coeur d'Alene region became productive. In 1930 lead ore and old tailings yielded metals valued at $10,820,301; lead-zinc ore, the next most valuable product, yielded $8,905,678. The total output of lead ore and old tailings from 53 producers in 1930 was 3 per cent greater than the output from 67 producers in 1929. Nearly 95 per cent of it was ore and old tailings of concentrating grade from 15 producers in Shoshone County; operators in Bonner, Butte, and Boise Counties also mined and shipped much lead ore. The increase in output of lead ore and old tailings, however, was due entirely to the milling of low-grade tailings, as nearly all the larger producers of lead ore decreased their output decidedly. The Bunker Hill & Sullivan property at Kellogg, Shoshone County, increased its output and produced about 45 per cent of the total output of lead ore, followed by the Hecla mine at Burke, the old tailings dump at Kellogg, the Gold Hunter mine at Mullan, the Dayrock property north of Wallace, the Sherman mine at Burke, and the Jack Waite property near Murray, all in Shoshone County. The Whitedelf mine in Bonner County led the mines in the other counties. The Livingston mine in Custer County, a large producer of lead ore in 1929, ceased milling ore in January. Two mines in Idaho produced from lead ore more than 53 per cent of the State's total output of lead in 1930. The average recovered content of the lead ore and old tailings in 1930 was 2 cents in gold and 4.24 ounces of silver to the ton, 0.035 per cent of copper, 8.235 per cent of lead, and 0.318 per cent of zinc.

COPPER-LEAD ORE

Three mines reported the output of 161,863 tons of copper-lead ore in Idaho in 1930. This was nearly double the quantity produced by five mines in 1929, and nearly all of it came from the Sunshine and Crescent mines near Kellogg in Shoshone County. The increase was due entirely to the abnormal output of the Sunshine (Yankee Boy) mine. Nearly all the copper-lead ore produced in 1930 was concentrated; the total output yielded 16.285 ounces of silver to the ton, 0.15 per cent of copper, and 0.53 per cent of lead.

ZINC ORE

All the zinc material produced in Idaho in 1930 was old tailings shipped to a custom mill at Wallace for milling.

LEAD-ZINC ORE

In 1930 lead-zinc ore in Idaho continued to rank second in quantity. For several years prior to 1929 the value of the metal yield from lead-zinc ore ranked second—after that from lead ore. In 1929, however, it took first place, but in 1930 resumed its position as second. The output of lead-zinc ore from 19 mines in Idaho in 1930 decreased 30 per cent from the output from 32 mines and dumps in 1929, and all of it was concentrated. The decrease was due to the decline in the price of zinc, and nearly all the larger producers of zinc curtailed their output. The Morning mine in Shoshone County produced more than half the total output of lead-zinc ore; other large producers were the Page, Star, Frisco, Triumph, Lost Pilgrim & Hall-Interstate, Constitution, Sidney, Blackhawk, Tamarack & Custer, and Golconda properties, all in Shoshone County except the Triumph in Blaine County and the Lost Pilgrim & Hall-Interstate in Valley County. The lead-zinc ore yielded 4 cents in gold and 3.40 ounces of silver to the ton, 0.038 per cent of copper, 7.01 per cent of lead, and 5.16 per cent of zinc.

Ore, old tailings, etc., sold or treated in Idaho in 1930, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ada	1	0.32	9			
Blaine	1	1.58	1			
Boise	[1] 22,631	9,893.72	13,130	1,064	8,756	
Camas	4	3.00	2			
Custer	66	150.91	141		66	
Elmore	24	9.06	3			
Idaho	[2] 8,293	3,632.80	9,250	1,295	795	
Lemhi	66	16.97	15	30		
Owyhee	252	228.68	2,371	10		
Valley	801	162.73	128			
Washington	281	79.85	25			
	32,420	14,179.62	25,075	2,399	9,617	
Total, 1929	26,459	12,709.23	15,886	1,456	10,851	

[1] Includes 1 ton of old mill cleanings treated by amalgamation.

[2] Includes 27 tons of old mill cleanings treated by amalgamation.

Ore, old tailings, etc., sold or treated in Idaho in 1930, by counties, with content in terms of recovered metals—Continued

DRY SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boise	677	40.32	5,745	365	5,715	----------
Bonner	20	1.00	150	49	826	----------
Butte	2	----------	109	----------	29	----------
Owyhee	[3] 101	19.45	3,596	23	----------	----------
Washington	37	.28	976	1,133	1,460	----------
	837	61.05	10,576	1,570	8,030	----------
Total, 1929	117	39.59	10,630	1,119	5,841	----------
COPPER ORE						
Blaine	5	0.80	23	390	----------	----------
Butte	34	3.00	667	2,741	----------	----------
Custer	26,218	769.51	24,026	1,121,874	----------	----------
Lemhi	6,844	37.05	794	253,502	----------	----------
Washington	28	----------	752	1,362	----------	----------
	33,129	810.36	26,262	1,379,869	----------	----------
Total, 1929	91,782	2,371.41	68,410	3,777,080	3,000	----------
LEAD ORE						
Blaine	164	19.23	15,591	1,361	119,118	----------
Boise	2,172	547.51	3,105	1,463	97,050	----------
Bonner	19,182	----------	85,960	2,216	1,912,796	----------
Butte	8,393	.14	18,893	95	1,667,385	----------
Camas	38	33.52	147	190	4,542	----------
Clark	22	----------	39	----------	13,971	----------
Custer	1,326	5.28	8,296	----------	336,444	----------
Lemhi	1,510	396.25	4,383	3,196	318,423	----------
Shoshone	[4] 1,019,137	71.68	4,325,832	728,473	168,775,838	6,689,544
Washington	18	.18	122	----------	18,144	----------
	1,051,962	1,073.79	4,462,368	736,994	173,263,711	6,689,544
Total, 1929	1,021,203	233.34	4,706,508	458,894	177,031,191	4,073,416
LEAD-ZINC ORE						
Blaine	25,779	141.51	183,588	32,469	3,478,155	6,146,421
Butte	8	.07	65	38	3,873	1,567
Camas	33	10.26	109	76	3,603	4,234
Shoshone	613,182	422.85	1,886,144	356,532	88,166,947	59,500,666
Valley	24,878	756.00	188,218	110,140	1,457,180	2,855,472
	663,880	1,330.69	2,258,124	499,255	93,109,758	68,508,360
Total, 1929	950,414	675.90	2,590,083	513,827	118,377,772	87,273,659

[3] Includes 100 tons of old tailings treated by cyanidation.

[4] Includes 114,387 tons of old tailings concentrated.

Zinc products (as marketed from Idaho mines and mills) sold to smelters or electrolytic plants in 1930

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Zinc concentrates	Blaine, Butte, Camas, Shoshone, and Valley.	68,286	73,773,571	54.02	67,758,305
Lead-zinc concentrates	Shoshone	8,816	8,158,640	46.27	7,539,867
		77,102	81,932,211	53.13	75,298,172
Total, 1929	----------	104,028	102,898,304	49.46	91,350,807

METALLURGIC INDUSTRY

The trend toward the adoption of straight flotation as a method of concentration of Idaho ores was continued during 1930. The construction of a new selective flotation mill of 500 tons daily capacity was completed early in 1931 by the Jack Waite Mining Co. to treat lead-zinc ore from its mine near Prichard, Shoshone County. The capacity of the flotation plant of the Sunshine Mining Co. was greatly increased by the addition of a new grinding and classification unit. The 200-ton flotation plant of the Pine Creek Lead-Zinc Mining Co. was completed early in 1930, and new crushing equipment was added to the Page mill of the Federal Mining & Smelting Co. Other mill construction in the Coeur d'Alene region included the erection of a new 100-ton mill by the Mutual Mines Development Co. near Wallace.

During 1930 four new milling plants were completed at mines not in the Coeur d'Alene region, including the 150-ton amalgamation and flotation plant of the Sherman Howe Mining Co. in Idaho County, the 100-ton amalgamation and flotation mill of the Goldstone Mines Corporation in Lemhi County, the 100-ton flotation plant of the Liberty Gem Mining Co. in Blaine County, and the 100-ton gravity and flotation mill of the Mineral Mining Co. in Boise County. No changes of importance were reported at the mills of the Bunker Hill & Sullivan Mining & Concentrating Co., Federal Mining & Smelting Co., or Hecla Mining Co.

The new electrolytic cadmium plant of the Sullivan Mining Co. at Silver King was completed and placed in operation in May, 1930, and the enlarged refinery department of the Bunker Hill smelter was in operation early in the year.

In Idaho 46 milling plants of all kinds were active in 1930, compared with 47 plants in 1929. Of these mills 28 were concentration plants, of which 6 used flotation machines with gravity concentration devices, 20 used flotation alone, and 2 used jigs and tables without flotation cells; 12 used amalgamation alone; 3 used amalgamation with concentration tables; 2 used amalgamation with flotation cells; and 1 used cyanidation. Besides the milling plants there was 1 electrolytic leaching plant that treated zinc concentrates. The following table lists the important mills that were active in 1930.

Mills in Idaho active in 1930[1]

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Ore and old tailings treated	Concentrates produced
Bunker Hill & Sullivan Mining & Concentrating Co.:			*Short tons per day*		
Crescent mill	Shont	Flotation	120	Copper-lead	Copper-lead.
South mill	Kellogg	do	500	Lead-zinc	Lead and zinc.
Sweeny custom mill	Bradley	do	200	do	Lead, lead-zinc, and zinc.
West mill	Kellogg	Gravity and flotation.	1,500	Lead	Siliceous silver (iron), lead, and zinc.
Callahan Zinc-Lead Co	Wallace	Flotation	200	do	Lead.
Constitution Mining & Milling Co.	Masonia	do	150	Lead-zinc	Lead-zinc.
Dickens Consolidated Mines Co.	Osburn	do	150	do	Lead and zinc.
Federal Mining & Smelting Co.:					
Hull mill	Gem	do	75	do	Do.
Morning mill	Mullan	do	1,200	do	Do.
Page mill	Kellogg	do	300	do	Do

[1] Seven small mills operating intermittently in 1930 are not included.

Mills in Idaho active in 1930—Continued

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Ore and old tailings treated	Concentrates produced
			Short tons per day		
Golconda Lead Mines	Wallace	Flotation	250	Lead-zinc	Lead and zinc.
Gold Hunter Mines (Inc.)	Mullan	do	500	Lead	Lead.
Hecla Mining Co	Gem	Gravity and flotation.	750	do	Lead and lead-zinc.
Hercules Mining Co. (custom mill).	Wallace	Flotation	800	Lead and lead-zinc.	Lead, lead-zinc, and zinc.
Jack Waite Mining Co	Prichard	do	150	Lead-zinc	Lead and zinc.
Livingston Mines Corporation.	Clayton	Gravity and flotation.	300	Lead	Lead.
Mackay Metals (Inc.)	Mackay	Flotation	250	Copper	Copper.
Sherman Howe Mining Co	Burgdorf	Amalgamation and flotation.	150	Gold	Gold.
Sunshine Mining Co	Shont	Flotation	500	Copper-lead	Copper-lead.
Whitedelf Mining & Development Co.	Clark Fork	do	75	Lead	Lead.
Wilbert Mining Co	Howe	Gravity	60	do	Do.
Winder-Stillman Con	Salmon	Flotation	150	Copper	Copper.

In 1930 nearly 2 per cent of the total ore, old tailings, etc., or 31,915 tons of ore and 128 tons of old tailings, etc., was treated in gold and silver mills; the gold and silver recovered were valued at $262,292, or $8.19 per ton of material treated. The companies used 565 pounds of quicksilver in 1930, an average of 0.0177 pound per ton of ore amalgamated and 0.0349 pound per ounce of gold and silver bullion saved.

Mine production of metals from gold and silver mills in Idaho in 1930, by counties, in terms of recovered metals

County	Ore, old tailings, etc., treated (dry weight)		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Blaine	1		1.58	1		
Boise	22,499	1	8,920.42	1,643		
Custer	66		116.87	85		
Elmore	24		9.06	3		
Idaho	8,236	27	3,343.13	1,648		
Lemhi	59		13.67	10		
Owyhee	29	100	31.90	40	2.45	236
Valley	801		162.73	128		
Washington	200		15.85	3		
	31,915	128	12,615.21	3,561	2.45	236
Total, 1929	25,797		11,634.13	7,603	9.66	11

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Boise	298	538.31	4,404	456	2,381
Custer	5	34.04	56		66
Idaho	24	278.55	7,577	182	795
Lemhi	2	3.00	3	30	
	329	853.90	12,040	668	3,242
Total, 1929	609	767.21	7,329	921	3,324

Of the total ore, old tailings, etc., 1,886,882 tons (97 per cent) were concentrated. For 1930 exact figures were again obtained giving the gross content of the mill feed. The results are presented in the accompanying tables, where they are separated by classes of ore, methods of concentration, and classes of concentrates produced. A table of metallurgical recoveries on ore concentrated is also given. Nearly 60 per cent of the ore concentrated was treated by straight flotation, more than 39 per cent by combined gravity and flotation, and less than one-half of 1 per cent by gravity without flotation equipment. The average assay of the lead ore treated by all methods was a trace of gold and 4.31 ounces of silver to the ton, 0.05 per cent of copper, 9.10 per cent of lead, and 1.17 per cent of zinc; the average assay of the lead-zinc ore treated by all methods was a trace of gold and 3.74 ounces of silver to the ton, 0.066 per cent of copper, 8.01 per cent of lead, and 6.93 per cent of zinc.

Idaho ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates

Class of material concentrated	Method of concentration	Ore and old tailings concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore:							
Siliceous silver	Flotation	665	45.72	6,560	700	6,500	
Copper sulphide	do	30,871	718.50	18,703	1,403,264		
Copper-lead sulphide	do	161,803		2,744,460	673,360	1,808,060	
Lead sulphide	do	203,063	72.45	888,443	218,110	27,148,838	
Lead-zinc sulphide	do	663,880	1,979.87	2,483,385	879,005	106,357,184	91,960,143
		1,060,282	2,816.54	6,141,551	3,174,439	135,320,582	91,960,143
Siliceous gold	Gravity and flotation	220	203.70	2,444			
Lead sulphide	do	702,674	1,017.50	3,029,587	761,220	137,068,444	21,418,773
		702,894	1,221.20	3,032,031	761,220	137,068,444	21,418,773
Siliceous gold	Gravity	7	1.00	3			
Copper sulphide	do	100	50.00	200	13,000		
Lead sulphide	do	8,405	21.80	23,518	350	2,151,700	
		8,512	72.80	23,721	13,350	2,151,700	
Total ore		1,771,688	4,110.54	9,197,303	3,949,009	274,540,726	113,378,916
Old tailings:							
Lead sulphide	Flotation	114,387		232,035	100,500	5,705,754	140,000
Zinc sulphide	do	807		1,500		35,000	136,235
Total old tailings		115,194		233,535	100,500	5,740,754	276,235
Grand total		1,886,882	4,110.54	9,430,838	4,049,509	280,281,480	113,655,151

Idaho ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates—Continued

Class of material concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore:								
Siliceous silver	Flotation	Siliceous silver	55	36.58	5,251	562	5,182	
Copper sulphide	do	Copper sulphide	2,781	625.91	16,012	1,226,770		
Copper-lead sulphide	do	Copper-lead sulphide	4,682		2,618,675	639,101	1,732,755	
Lead sulphide	do	Lead sulphide	22,532	62.08	787,036	149,554	24,449,455	
Lead-zinc sulphide	do	do	65,749	748.63	1,898,877	312,099	91,163,546	
		Lead-zinc sulphide	7,273	113.61	71,741	33,960	2,102,258	6,717,914
		Zinc sulphide	63,022	468.45	287,506	231,944	3,652,867	67,935,360
			136,044	1,330.69	2,258,124	578,003	96,918,671	74,653,274
			166,094	2,055.26	5,685,098	2,593,990	123,106,063	74,653,274
Siliceous gold	Gravity and flotation	Siliceous gold	2	190.08	2,256			
Lead sulphide	do	Iron sulphide	1,975		5,936	2,381	135,017	
		Lead sulphide	120,411	911.93	2,847,361	634,615	128,514,565	
		Lead-zinc sulphide	1,543		15,637	12,000	288,749	1,440,726
		Zinc sulphide	5,063		29,981	25,000	252,152	5,679,134
			128,992	911.93	2,898,915	673,996	129,190,483	7,119,860
			128,994	1,102.01	2,901,171	673,996	129,190,483	7,119,860
Siliceous gold	Gravity	Siliceous gold	1	.30	2			
Copper sulphide	do	Copper sulphide	27	32.37	131	10,955		
Lead sulphide	do	Lead sulphide	1,406	17.43	18,812	282	1,721,412	
			1,434	50.10	18,945	11,237	1,721,412	
Total from ore			296,522	3,207.37	8,605,214	3,279,223	254,017,958	81,773,134
Old tailings:								
Lead sulphide	Flotation	Lead sulphide	3,634		184,288	60,201	3,659,640	
		Zinc sulphide	91		431		8,589	50,089
Zinc sulphide	do	do	110		800		13,000	108,988
Total from old tailings			3,835		185,519	60,201	3,681,229	159,077
Grand total			[1] 300,357	3,207.37	8,790,753	3,339,524	257,699,187	81,932,211

[1] Figures do not include 329 tons of concentrates from ore treated at amalgamation plants, containing 853.90 ounces of gold, 12,040 ounces of silver, 1,014 pounds (668 pounds recovered) of copper, and 3,412 pounds (3,242 pounds recovered) of lead.

Metallurgic results obtained by concentration of Idaho ore and old tailings in 1930

Material treated	Concentrates produced	Ratio of concentration	Per cent recovered in concentrates				
			Gold	Silver	Copper	Lead	Zinc
Ore by flotation:							
Siliceous silver	Siliceous silver	12.09:1	80.01	80.05	80.29	79.72	-------
Copper sulphide	Copper sulphide	11.10:1	87.11	85.61	87.42	--------	-------
Copper-lead sulphide	Copper-lead sulphide	34.56:1	--------	95.42	94.91	95.84	-------
Lead sulphide	Lead sulphide	9.01:1	85.69	88.59	68.57	90.06	-------
Lead-zinc sulphide	do	10.10:1	37.81	76.46	35.51	85.72	-------
	Lead-zinc sulphide	91.28:1	5.74	2.89	3.86	1.98	7.31
	Zinc sulphide	10.53:1	23.66	11.58	26.39	3.43	73.87
Total lead-zinc sulphide		4.88:1	67.21	90.93	65.76	91.13	81.18
Total ore by flotation		6.38:1	72.97	92.57	81.71	90.97	81.18
Ore by gravity and flotation:							
Siliceous gold	Siliceous gold	110.00:1	93.31	92.31	--------	--------	-------
Lead sulphide	Iron sulphide	---------	--------	.20	.31	.10	-------
	Lead sulphide	5.84:1	89.62	93.98	83.37	93.76	-------
	Lead-zinc sulphide	---------	--------	.52	1.58	.21	6.73
	Zinc sulphide	138.79:1	--------	.99	3.28	.18	26.51
Total lead sulphide		5.45:1	89.62	95.69	88.54	94.25	33.24
Total ore by gravity and flotation.		5.45:1	90.24	95.68	88.54	94.25	33.24
Total ore and old tailings by all methods.		6.28:1	78.03	93.21	82.47	91.94	72.09

Metals recovered from the concentrates—from ore concentrated, from 115,194 tons of old tailings re-treated, and from part of the ore treated in gold and silver mills—were valued at $66.02 per ton of concentrates, compared with $82.85 in 1929. The concentrates came largely from the Coeur d'Alene region, where the ratio of concentration was about 6.31 tons of ore and old tailings to 1 ton of concentrates. There were marked decreases in the production of copper concentrates, lead concentrates, lead-zinc concentrates, zinc concentrates, and siliceous concentrates, but there was an increase in the quantity of copper-lead concentrates.

Operators in Shoshone County shipped an average of 23,405 tons of concentrates of various kinds a month, compared with 26,819 tons in 1929. This amount, with the crude ore shipped to smelters (1,845 tons a month), gives the Coeur d'Alene region an average monthly output of 25,250 tons of concentrates and crude ore, compared with 29,136 tons in 1929. The average value of metals recovered from lead concentrates decreased from $90.49 to the ton of concentrates in 1929 to $67.22 in 1930, that from zinc concentrates from $65.37 to $52.68, that from copper concentrates from $88.50 to $63.04, and that from lead-zinc concentrates from $69.75 to $58.48. The average value of the copper-lead concentrates, which contained chiefly silver, decreased nearly 22 per cent; but the average value of the siliceous concentrates, which contained chiefly gold, increased from $9.01 in 1929 to $16.65 in 1930.

Mine production of metals from concentrating mills in Idaho in 1930, by counties, in terms of recovered metals

County	Ore and old tailings treated		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	25, 779		9, 505	141. 51	183, 588	32, 469	3, 478, 155	6, 146, 421
Boise	2, 857		295	344. 09	8, 356	1, 800	102, 045	
Bonner	18, 662		1, 128		69, 886	1, 776	1, 516, 808	
Butte	8, 389		1, 403	. 07	18, 807	91	1, 662, 185	1, 567
Camas	67		16	27. 69	179	207	4, 715	4, 234
Custer	25, 401		2, 668	626. 51	23, 704	957, 458	336, 444	
Lemhi	7, 843		476	392. 01	1, 372	252, 737	36, 320	
Owyhee	220		2	190. 08	2, 256			
Shoshone	1, 657, 592	115, 194	280, 860	186. 38	8, 294, 367	1, 492, 483	239, 275, 933	66, 290, 478
Valley	24, 878		4, 004	756. 00	188, 218	110, 140	1, 457, 180	2, 855, 472
	1, 771, 888	115, 194	300, 357	2, 207. 77	8, 790, 733	2, 849, 161	247, 869, 785	75, 298, 172
Total, 1929	2, 059, 601	41, 133	344, 481	2, 440. 68	8, 617, 756	3, 898, 631	273, 230, 449	91, 350, 807

Gross metal content of Idaho concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	2, 362	1, 080. 86	25, 485	3, 957	143, 611	
Copper	2, 808	658. 28	16, 143	1, 237, 725		
Lead	213, 732	1, 740. 07	5, 736, 374	1, 156, 851	249, 568, 618	
Zinc	68, 286	468. 45	318, 718	256, 944	3, 926, 608	73, 773, 571
Copper-lead	4, 682		2, 618, 675	639, 101	1, 732, 755	
Lead-zinc	8, 816	113. 61	87, 378	45, 960	2, 331, 007	8, 158, 640
	300, 686	4, 061. 27	8, 802, 773	3, 340, 538	257, 702, 599	81, 932, 211
Total, 1929	345, 090	3, 177. 79	8, 625, 085	4, 371, 925	287, 962, 590	102, 898, 304

Mine production of metals from Idaho concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	9, 505	141. 51	183, 588	32, 469	3, 478, 155	6, 146, 421
Boise	593	1, 122. 40	12, 760	2, 256	104, 426	
Bonner	1, 128		69, 886	1, 776	1, 516, 808	
Butte	1, 403	. 07	18, 807	91	1, 662, 185	1, 567
Camas	16	27. 69	179	207	4, 715	4, 234
Custer	2, 673	960. 58	23, 760	957, 458	336, 510	
Idaho	24	278. 55	7, 577	182	795	
Lemhi	478	398. 01	1, 375	252, 767	36, 320	
Owyhee	2	190. 08	2, 256			
Shoshone	280, 860	186. 38	8, 294, 367	1, 492, 483	239, 275, 933	66, 290, 478
Valley	4, 004	756. 00	188, 218	110, 140	1, 457, 180	2, 855, 472
	300, 686	4, 061. 27	8, 802, 773	2, 849, 829	247, 873, 027	75, 298, 172
Total, 1929	345, 090	3, 177. 79	8, 625, 085	3, 859, 552	273, 235, 773	91, 350, 807

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous	2, 362	1, 080. 86	25, 485	2, 676	136, 504	
Copper	2, 808	658. 28	16, 143	1, 209, 193		
Lead	213, 732	1, 740. 07	5, 736, 374	889, 691	240, 148, 840	
Zinc	68, 286	468. 45	318, 718	222, 487	3, 673, 074	67, 758, 305
Copper lead	4, 682		2, 618, 675	484, 877	1, 667, 475	
Lead-zinc	8, 816	113. 61	87, 378	40, 905	2, 247, 134	7, 539, 867

Of the total ore, etc., 1.34 per cent was shipped crude to smelters at Bradley, Idaho; East Helena, Mont.; Tacoma, Wash.; and plants near Salt Lake City, Utah. The total value of the metals recovered from first-class ore was $1,298,163, compared with $2,180,130 in 1929. Of the crude ore shipped to smelters 90 per cent was lead ore, and nearly all the remainder was copper ore; 88.6 per cent of the ore smelted was sulphide, although 97 per cent of the copper ore was carbonate.

Gross metal content of Idaho crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	324	544. 26	12, 391	3, 794	9, 768
Copper	2, 158	152. 08	10, 119	174, 893	------------
Lead	23, 433	82. 35	572, 886	102, 869	20, 988, 077
Copper-lead	60	------------	17, 318	9, 525	47, 412
	25, 975	778. 69	612, 714	291, 081	21, 045, 257
Total, 1929	47, 557	1, 288. 55	779, 971	1, 304, 051	25, 421, 875

Mine production of metals from Idaho crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ada	1	0. 32	9	------------	------------
Blaine	169	20. 03	15, 614	1, 751	119, 118
Boise	143	438. 73	7, 577	636	7, 095
Bonner	570	1. 00	16, 224	489	396, 814
Butte	48	3. 14	927	2, 783	9, 102
Camas	18	19. 09	79	59	3, 430
Clark	22	------------	39	------------	13, 971
Custer	2, 144	149. 39	25, 975	171, 007	45, 672
Idaho	30	11. 12	25	1, 113	------------
Lemhi	518	38. 56	3, 807	3, 961	282, 103
Owyhee	5	24. 70	3, 482	33	------------
Shoshone	22, 143	8. 15	537, 084	77, 399	19, 346, 027
Washington	164	64. 46	1, 872	2, 495	19, 604
	25, 975	778. 69	612, 714	261, 726	20, 242, 936
Total, 1929	47, 557	1, 288. 55	779, 971	1, 231, 827	24, 142, 317

BY CLASSES OF ORE

Dry and siliceous	324	544. 26	12, 391	2, 964	9, 410
Copper	2, 158	152. 08	10, 119	170, 676	------------
Lead	23, 433	82. 35	572, 886	81, 495	20, 187, 854
Copper-lead	60	------------	17, 318	6, 591	45, 672

The combined value of the metals from concentrates and crude shipping ore was $21,149,625, compared with $30,772,193 in 1929.

No miscellaneous material other than old tailings concentrated and cyanided and 28 tons of clean-up material was reported for 1930, and no ore was treated locally by either leaching or roasting methods.

REVIEW BY COUNTIES AND DISTRICTS

ADA COUNTY

Black Hornet district.—A test lot of gold ore was shipped by the Gold Star Mining Co.; and a little development was reported at the Sorrel Horse, Monarch, Blue Grouse, and Idaho groups.

Highland district.—Placer bullion valued at about $450 was marketed from two prospects on the Boise River.

ADAMS COUNTY

No production was reported from Adams County in 1930. The Blue Jacket mine in the Seven Devils district, a producer of copper ore in 1929, was idle in 1930.

BEAR LAKE COUNTY

The Sunset Mining Co., which shipped two cars of lead ore from the Sunset mine in the St. Charles district in 1929, did a little development but shipped no ore in 1930.

BLAINE COUNTY

The value of the production of metals in Blaine County decreased from $624,377 in 1929 to $559,406 in 1930, chiefly because of the decline in metal prices as the output of each of the five metals except gold increased. The Triumph mine, which adjoins the North Star property of the Federal Mining & Smelting Co., continued to be the chief producer in the county; its output of silver, lead, and zinc increased considerably. From 1880 to 1930 Blaine County has produced $2,576,156 in gold, $16,676,017 in silver, $72,435 in copper, $9,602,866 in lead, and $1,616,341 in zinc, a total of $30,543,815. The quantities of the various metals follow: Gold, 124,623.29 fine ounces; silver, 18,556,321 fine ounces; copper, 426,914 pounds; lead, 211,350,194 pounds; and zinc, 24,693,987 pounds. In 1930 Blaine County ranked second in value of mine production in Idaho, following Shoshone County.

A bulletin [4] describing the geology and ore deposits in the vicinity of Hailey and Ketchum and giving the early production of some of the important mines was published in 1930.

Mineral Hill district (Hailey).—Five lode mines in the Mineral Hill district produced 33 tons of ore yielding $56 in gold, 1,668 ounces of silver, 418 pounds of copper, and 10,416 pounds of lead, valued in all at $1,274, or $38.61 in metals a ton. With the exception of 1 ton of ore amalgamated the output consisted chiefly of sulphide lead ore shipped directly to a smelter. Small sample lots of lead ore were shipped from the Carbonate and Lone Pine Tree properties; a test lot of copper ore from the Doodle Bug prospect was marketed; a car of first-class sulphide lead ore, rich in silver, from the Star mine was shipped to Murray, Utah, for smelting; and a small quantity of gold ore was produced from the Camas No. 1 claim. Development was continued at the Liberty Gem group 8 miles west of Hailey by the Liberty Gem Mining Co. The main shaft was deepened to the 200-foot level, and about 240 feet of lateral work was done; a 100-ton flotation plant was under construction during 1930. A new shaft at the adjoining Badger property, controlled by the Day interests of Wallace, reached a depth of 55 feet. The Homestake Mines Corporation reported 600 feet of tunneling and 200 feet of raising at the Homestake mine near Ketchum, and a little development was done at the Queen of the Hills property.

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[4] Umpleby, J. B., Westgate, L. G., and Ross, C. P., Geology and Ore Deposits of the Wood River Region, Idaho: U. S. Geol. Survey Bull. 814, 1930, 250 pp.

Warm Springs district (*Ketchum*).—Five lode mines in the Warm Springs district produced 25,916 tons of ore yielding $3,316 in gold, 197,535 ounces of silver, 33,802 pounds of copper, 3,586,857 pounds of lead, and 6,146,421 pounds of zinc, valued in all at $558,132, or $21.54 in metals a ton. The value of the output of this district was the largest of any district, exclusive of the Coeur d'Alene region, in Idaho in 1930. Of the total output 137 tons (all lead ore) were first-class ore shipped to a smelter, and 25,779 tons were lead-zinc ore of milling grade which yielded 9,505 tons of concentrates. Most of the output was lead-zinc ore from the Triumph property, containing chiefly sphalerite and galena; it was shipped to the flotation plant of the Combined Metals Reduction Co. at Bauer, Utah, where it was separated into lead concentrates and zinc concentrates. The Triumph mine ranked second as a producer of zinc in Idaho in 1930, eleventh as a producer of lead, and eleventh as a producer of silver. The property is opened by a vertical shaft and various drifts, and development in 1930 consisted of 300 feet of inclined winze and 1,000 feet of drifts; the mine was closed in October after the marked drop in metal prices. The North Star mine, owned by the Federal Mining & Smelting Co., was operated by lessees who shipped two cars of lead-zinc ore to the flotation mill at Midvale, Utah, and a car of crude ore to a smelter. First-class lead ore of smelting grade was marketed from the Independence, Baltimore & Victoria, and Imperial properties. A little development was reported at the Lone Pine and Silver Crown properties near Ketchum.

BOISE COUNTY

The value of the production of metals in Boise County increased from $265,261 in 1929 to $288,874 in 1930 as a result of the increased production of siliceous gold ore from the Gold Hill & Iowa mine of the Talache Mines (Inc.), which became the largest producer of gold in Idaho, and the increased output of gold from the dredge operated by the Idaho Gold Dredging Corporation. The Idawa Gold Mining Co. decreased its production of gold considerably and dropped to second place among the Idaho gold producers. The placer production was valued at $57,787, an increase of $4,257 over that in 1929, due chiefly to the increased output of the dredge at Centerville, operated by the Idaho Gold Dredging Corporation.

Banner district.—The Crooked River Mining Co. continued operations at its 1,940-acre tract of placer ground on Crooked River; repaired the dredge, which is driven by a Diesel engine and has a capacity of 1,500 cubic yards daily; and treated about 60,000 cubic yards of gravel in 46 operating days. The bullion, valued at $5,500, was sent to the assay office at Boise.

Boise Basin district (*Centerville, Placerville, Idaho City, Pioneerville*).—Six placers and 10 lode mines in the Boise Basin district produced 25,449 tons of ore, $267,929 in gold, 22,421 ounces of silver, 2,853 pounds of copper, and 111,521 pounds of lead, valued in all at $282,508. The ore had an average value of $9.05 in metals a ton. The placer output consisted of $51,983 in gold and 789 ounces of silver, valued together at $52,287.

The Gold Hill & Iowa mine, the largest producer of gold in Idaho in 1930, was operated continuously during the year by the Talache Mines (Inc.), which treated 15,806 tons of ore in the 125-ton amalgamation mill, producing bullion containing 5,748.65 ounces of gold and 655 ounces of silver. The net value of the bullion was $118,508, compared with $93,000 in 1929. Development during the year consisted of 1,407 feet of drifting, 660 feet of crosscutting, 294 feet of raising, and 84 feet of shaft sinking. The vein was opened on the 850-foot level and found to be of normal thickness and grade. The ore contains free gold associated with a lead-bismuth mineral, and very fine grinding is necessary. The mill is equipped with machinery for gravity concentration; but the concentrates are reground and amalgamated, and bullion is the only product marketed.

The output of gold from the Belshazzar mine, operated by the Idawa Gold Mining Co., was about 30 per cent less in 1930 than in 1929. Additional machinery for table concentration was installed in the 30-ton amalgamation and concentration mill, which improved the grade of the concentrates; the concentrates are shipped to Utah for smelting. Most of the gold, however, was recovered in the form of amalgamation bullion which is sent to Boise. The company reported 1,600 feet of drifting and crosscutting during the year.

The Mineral Mining Co. continued active development of the Smuggler, Big Enterprise, and Blackbird group near Pioneerville and reported 600 feet of drifting. The company's 100-ton gravity and flotation mill was completed and operated intermittently on ore produced during development, and lead concentrates were shipped to Midvale, Utah, for smelting. The Native Missourian property was operated by the Missouri Mining Co. which treated nearly 700 tons of gold ore in a small flotation plant. The concentrates, together with a small lot of crude smelting ore, were shipped to Midvale, Utah, for smelting. About 600 feet of drifting was reported. Operators of the K. C. group shipped 85 tons of gold ore to the mill of the Mineral Mining Co. for treatment and marketed a car of siliceous gold ore of smelting grade. The remainder of the district output consisted of two cars of rich gold ore from the Comeback mine, shipped to a smelter, and small lots of siliceous gold ore from the Buckhorne and Mountain Chief properties, treated by amalgamation. Development aggregating 750 feet was done at the Comeback mine. Mine development, chiefly in tunneling and drifting, was reported at the Hay Fork & Black Eagle, Mammoth, Mayflower, and Buckskin properties.

The placer output of the district was chiefly bullion from the Grimes Creek operations of the Idaho Gold Dredging Corporation. The dredge was worked 257 days during 1930 and handled more than 365,000 cubic yards of gravel. Bullion valued at about $49,000 was sent to the assay office at Boise. Due to the lack of sufficient water no hydraulicking was done at the property of the Boise Placer Co., but a small quantity of bullion from clean-up operations was marketed. The Franklin Placer Co. treated about 1,000 cubic yards of gravel by the hydraulic method and shipped bullion valued at about $1,200 to Boise. Small quantities of placer bullion were also marketed from sluicing operations at the Gold Hill, Swede Gulch, and various small properties on Grimes Creek.

Summit Flat district.—Test lots of rich gold ore from the Golden Dividend and Mademoiselle mines were treated by pan amalgamation.

BONNER COUNTY

The value of the production of metals in Bonner County decreased $28,552 in 1930, due to the curtailed output of silver-lead ore from the Elsie K. property and to the decline in metal prices. The Whitedelf Mining & Development Co., the largest producer in the county, increased its output of silver and lead decidedly.

A bulletin [5] giving the geology of the region near Clark Fork was issued early in 1930.

Lakeview district.—A car of silver ore from the Minerva mine, opened in a short crosscut from the main tunnel, was shipped to Kellogg for smelting. A little development was reported at the Hewer mine, a producer of silver-lead ore from 1924 to 1927.

Pend d'Oreille district.—The value of the output from the Pend d'Oreille district decreased nearly 18 per cent from that in 1929, due chiefly to the decline in the price of lead and silver. The Whitedelf Mining & Development Co. was again the largest producer in the district. The company treated 18,600 tons of lead ore in the 75-ton flotation plant and shipped 1,123 tons of lead concentrates containing 69,676 ounces of silver, 1,989 pounds of copper, and 1,568,135 pounds of lead to East Helena, Mont., for smelting. In addition to the concentrates the company shipped several hundred tons of first-class lead ore. Development in 1930 consisted of 577 feet of tunnel work and 48 feet of shaft sinking. The new flotation plant, having a capacity of about 75 tons a day, was placed in operation in August, 1929. It is equipped with a jaw crusher, rolls, a 6-foot Hardinge ball mill in closed circuit with a 4-foot Dorr classifier, one 8-cell Minerals Separation Sub-A flotation machine, a 12-foot Dorr thickener, and a 3 by 4 foot Oliver filter. The remainder of the district output consisted of several cars of lead ore of milling grade, shipped to the Hercules plant at Wallace, and one car of first-class lead ore, shipped to East Helena, Mont., from the Elsie K. mine, operated by the Hope Mining Co., which reported 1,140 feet of drifting during the year. The output was considerably less than that in 1929. No ore was shipped from the Lawrence mine in 1930, and the 50-ton gravity concentrator was idle. A limited amount of development was reported at the Lawrence, Bonner, Lone Butte, Opportunity, and Syringa properties during the year.

BONNEVILLE COUNTY

A small quantity of exceptionally pure placer gold, produced by hydraulic operations at a property near Caribou Mountain, was marketed by the Idaho Consolidated Placer Mining Co.

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[5] Anderson, A. L., Geology and Ore Deposits of the Clark Fork District, Idaho: Idaho Bur. of Mines and Geol. Bull. 12, March, 1930, 132 pp.

BOUNDARY COUNTY

No production was reported from mines in Boundary County in 1930. The production of metals in the county has been relatively unimportant since the closing of the mill of the Idaho Continental Co. in February, 1928.

Moyie Yahk district (Bonners Ferry).—A limited amount of development was reported at the Bethlehem, Idamont (Idaho Gold & Ruby), North Idaho (Eureka, Elba, etc.), and Silver Spoon properties.

BUTTE COUNTY

The production of metals in Butte County was valued at $91,677 in 1930, a decrease of $174,774 from 1929, due entirely to the large decrease in the output of lead and silver from the Wilbert mine near Howe.

Dome district.—The Wilbert Mining Co. continued operations at its property 23 miles north of Arco during 1930 but at a much lower rate than in 1929. The 60-ton gravity concentrator treated about 8,400 tons of lead ore in 1930 compared with more than 14,000 tons in 1929, and the output of lead was more than 2,000,000 pounds less than that in 1929. The company reported 1,000 feet of development in 1930, including the opening of the 1,450-foot level from a winze below the main tunnel. The remainder of the district output consisted of test lots of lead ore and silver ore from the Great Western mine and a little silver ore from the Brown prospect. About 300 feet of development was done at the Great Western property.

Lava Creek district.—A car of low-grade copper ore was shipped from the Hornsilver mine to Garfield, Utah, for smelting; and a little development, chiefly in extending the No. 3 tunnel, was reported. A little lead ore of smelting grade and a little lead-zinc milling ore were shipped from the Edna mine. The St. Louis mine was idle in 1930.

CAMAS COUNTY

Beaver Creek district.—The Consolidated Mines Syndicate shipped one car of first-class lead ore and one car of lead-zinc milling ore from the Princess-Blue Ribbon mine 12 miles from Blaine and reported 1,000 feet of development, including the sinking of a short winze from the lower tunnel.

Gold Belt district.—As in 1929, a small lot of gold ore was shipped from the Yellow Jacket property.

Little Smoky district.—The Perseverance Mining Co. continued operations at the Five Points property 12 miles north of Fairfield, treated a little lead ore in a small gravity mill, and reported 235 feet of drifting in the No. 4 tunnel. A little development was reported at the Horn Silver mine.

CASSIA COUNTY

No production has been reported from mines in Cassia County since 1926. During 1930 the Silver Hills Mining Co. reported the erection of new surface equipment and 275 feet of tunnel work at the Joveon & Busy Bee property in the Black Pine district near the Utah State line.

CLARK COUNTY

The Beaver Head Mining Co. shipped a car of oxidized lead ore from the Scott mine, 65 miles northwest of Idaho Falls.

CLEARWATER COUNTY

The geology and mineral resources of the region about Orofino were reviewed by the Idaho Bureau of Mines and Geology [6] in 1930.

Moose Creek district.—Placer bullion valued at $664 was marketed from the Poor Man, Independence, and Tallmadge placers on Independence and Moose Creeks.

Pierce district.—The output of the Pierce district consisted of small lots of placer bullion from the Huckleberry & Homestake, Mox Mox, and one other property.

Ruby Creek district.—The Ruby Creek Mining Co. reported the expenditure of $9,000 for mine development and mill equipment at its Ruby Creek property in 1930.

CUSTER COUNTY

The value of the production of metals in Custer County decreased from $977,999 in 1929 to $204,318 in 1930, the largest decrease in any county except Shoshone. This large decrease was due to the closing of the Mackay Metals property in August and to the inactivity of the mill of the Livingston Mines Corporation after January. Although the Mackay Metals (Inc.) decreased its output decidedly, it held its position as the largest producer of copper in Idaho in 1930, ranked sixth as a producer of gold, and produced considerable silver.

Alder Creek district (Mackay).—The Mackay Metals (Inc.) was the only producer in the Alder Creek district in 1930. The mine and 250-ton flotation plant were run continuously until August 1, when all operations were suspended due to the low price of copper. The mill treated 24,135 tons of copper ore and produced 2,379 tons of concentrates containing 600 ounces of gold, 14,683 ounces of silver, and 933,529 pounds of copper. In addition to the milling ore the mine produced 2,032 tons of first-class smelting ore containing about 4 per cent of copper. The output of copper in 1930 was 1,700,000 pounds less than that in 1929, but the company retained its position as the leading producer of copper in Idaho. The property is opened by two tunnels, the Alberta and the Cossack. The lower (Cossack) tunnel is about 1,000 feet below the Alberta, and during 1930 the face was advanced to a point 6,000 feet from the portal. A 600-foot vertical raise will be driven from the Cossack tunnel to connect with the 350-foot winze from the Alberta tunnel. The company reported 1,300 feet of development during the year, including the work in the lower tunnel. A pamphlet [7] describing the geology and ore deposits of this district was published in 1930.

Bay Horse district.—The Ramshorn mine was again operated by lessees who shipped two cars of first-class copper-lead ore, containing nearly 300 ounces of silver to the ton, to Midvale, Utah, for smelting. A limited amount of development was reported by the Idaho Hermit Mines (Inc.) and the Mule Shoe Mining Co.

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[6] Anderson, A. L., The Geology and Mineral Resources of the Region about Orofino, Idaho: Idaho Bur. of Mines and Geol. Pamph. 34, 1930, 63 pp.

[7] Ross, C. P., Geology and Ore Deposits of the Seafoam, Alder Creek, Little Smoky, and Willow Creek Mining Districts, Custer and Camas Counties, Idaho: Idaho Bur. of Mines and Geol. Pamph. 33, 1930, 26 pp.

Boulder district.—Active mining and milling operations were carried on at the property of the Livingston Mines Corporation during January only. Development continued for the following five months, but the property has been idle since July 19, 1930. The company treated 1,326 tons of lead ore in the 300-ton table and flotation mill during January and shipped 289 tons of concentrates to Midvale, Utah, for smelting. The output of lead decreased more than 4,000,000 pounds from that in 1929. The company reported 1,150 feet of development during the year.

Seafoam district.—The Seafoam Mines Corporation operated its Silver King & Providence property for about three months during the year, mostly on development. A little gold ore, mined during development, was treated in a small amalgamation mill; a little bullion and a few tons of gold concentrates were marketed.

Stanley Basin district.—Small lots of placer gold were recovered from operations at several claims near Stanley, including the Jose Gulch and W. K. Lynch properties.

Yankee Fork district.—The output from the Yankee Fork district consisted of a test lot of gold and silver ore from the Monte Carlo mine, a little copper ore from the Why Not property of the Estes Mountain Gold Mining Co., and a little gold ore mined from a prospect and treated by pan amalgamation.

ELMORE COUNTY

The value of the production of metals in Elmore County increased from $811 in 1929 to $1,129 in 1930. The metal output of the county has been unimportant since the operations of the South Park Dredging Co. in the Bear Creek district were suspended in 1928.

Middle Boise district (Atlanta).—Four placers and one lode mine in the Middle Boise district produced 23 tons of ore, $854 in gold, and 17 ounces of silver, valued together at $860. The placer output consisted of small lots of bullion from the Joe Surger, Twilegar, Kinsela, and Campbell claims near Troutdale. A little gold ore from the Winner group was treated by amalgamation. A limited amount of development, mostly in advancing the main tunnel, was reported by the St. Joseph Lead Co., operating the Monarch and Boise-Rochester groups.

Twin Springs district.—As in 1929, a small quantity of placer bullion was recovered from the Sunflower claim on the Boise River.

GEM COUNTY

Squaw Creek district.—The American Mines Development Co. continued operations at the Old Liberty group on Squaw Creek and advanced the new tunnel 1,000 feet but shipped no ore.

West View district (Emmett, Eagle).—Production from the West View district in 1930 consisted of a little placer bullion marketed from a property on Anderson Creek near Montour. About 350 feet of development was done at the Premier property near Emmett. The Lincoln mine, a producer of several hundred tons of gold ore in 1929, was idle in 1930.

IDAHO COUNTY

The production of metals in Idaho County was valued at $82,046 in 1930, an increase of $33,347 over 1929. The closing of the property of the Unity Gold Mines Co. in March resulted in a large decrease in the gold output from the Warren district, but this loss was more than offset by the output from the Sherman Howe mine, near Burgdorf, in the Marshall Lake district, which accounted for all the increase in the county.

Dixie district.—A little placer gold was marketed from the James Moore property near Dixie, and a little road repair and tunnel work was reported at the Mammoth group by the Mammoth Mining & Development Co.

Elk City district.—The placer output from the Red Horse, Deadwood, Leonard, Mullady, and Allison properties was valued at $706, compared with $286 from three properties in 1929. A little gold ore from the Elkhorn mine was treated by pan amalgamation, and a test lot of gold ore was shipped from the Bengal property. About 150 feet of tunnel work was reported at the Hercules group at Elk City.

Harpster district (*Grangeville*).—One car of gold ore containing a little copper was shipped from the Dewey mine 6 miles east of Grangeville to Tacoma, Wash., for smelting.

Marshall Lake district (*McCall*).—The Sherman Howe Mining Co. operated its property 17 miles northwest of Burgdorf continuously during 1930. Camp construction, started in 1929, was completed during 1930, and the new 150-ton amalgamation and flotation mill was placed in operation in January, 1930. The property owned by the company consists of 42 unpatented claims covering the western extension of the Holte vein system in the adjoining Golden Anchor property. The mine is opened by two tunnels and several hundred feet of drifts and raises; the No. 2, or operating, tunnel is 2,200 feet long. Nearly all the development was done during 1930. The ore is largely free-milling, and the gold is associated with certain sulphide minerals. The mill is designed to recover most of the gold in the form of bullion and the remainder in a flotation concentrate. The mill equipment includes an 8-inch Traylor gyratory crusher, a 4 by 8 foot Marcy rod mill in closed circuit with a 3-foot Dorr Simplex classifier, four silver-plated copper amalgamation plates 4 by 12 feet, a No. 54 Marcy ball mill in closed circuit with a 4-foot Dorr Duplex classifier, an 8-cell Fahrenwald flotation machine, an 8 by 14 foot Dorr thickener, and a 3 by 4 foot Oliver filter. The overflow from the rod-mill classifier is distributed to the four amalgamation plates, where most of the bullion is recovered. The tailings from the plates pass to the regrinding circuit and advance to the flotation machine, first passing over an 8-foot Hoyt riffle where the remainder of the bullion is saved. The flotation concentrates contain more than 10 ounces of gold to the ton and are sacked for shipment to a smelter near Salt Lake City, Utah; bullion is deposited at the assay office at Boise. During 1930 the mill was operated intermittently on ore produced from development operations. The property was the largest producer in Idaho County and ranked third in the production of gold in the State in 1930. The remainder of the district output consisted of small lots of gold ore from the Leadville, Cuban, and Alberta properties, treated by amalgamation. No production was reported from the Golden Anchor property adjoining the Sherman Howe, but the company did about 1,000 feet of drifting and crosscutting during the year. The mine is held under option by the United Verde Extension Mining Co. of Arizona.

Meadow Creek (Green Mountain) district.—The Bunker Hill & Sullivan Mining & Concentrating Co. discontinued exploration of the Copper King property late in 1930, reporting that the ore bodies opened were too small to be of commercial value.

Simpson district.—Small lots of placer gold were marketed from the Hawk, Seelridge, Robie Bar, and Brice placers on the Salmon River. The Salmon River Development Co. was idle in 1930.

Ten Mile district (Golden).—Two placers and four lode mines in the Ten Mile district produced 903 tons of ore, $14,610 in gold, and 284 ounces of silver, valued together at $14,719, a decrease from $19,328 in 1929. The Lone Pine mine near Golden was again the largest producer in the district. More than 700 tons of gold ore were treated in a small 2-stamp amalgamation mill, and bullion valued at about $9,600 was marketed. A total of 2,122 feet of development has been done at the mine, including 732 feet reported in 1930. Gold ore from the Mackey mine of the Buffalo-Idaho Mining Co. and the New York property of the Central Idaho Gold Mines (Inc.) was also treated in small stamp mills by amalgamation. Placer gold valued at about $450 was recovered by hydraulicking 2,000 cubic yards of gravel at the property of the Moose Creek Placers Co.

Warren district.—Six placers and three lode mines in the Warren district produced 327 tons of ore, $9,379 in gold, 1,084 ounces of silver, 25 pounds of copper, and 227 pounds of lead, valued in all at $9,810, a large decrease from $27,879 in 1929. The decrease was due to the closing of the mine and mill of the Unity Gold Mines Co. near Warren on March 20, 1930. The output of gold from the mine was only one-third that in 1929, and the property dropped from fifth to tenth place in output of gold in Idaho in 1930. The placer output was valued at $1,480 and came chiefly from the Golden Rule property on Grouse Creek 6 miles east of Burgdorf. Other producing placers were the Buck Diggings, Golden Seal, Laughing Water, Shissler Creek, and Thomas Creek properties.

KOOTENAI COUNTY

No ore was marketed from properties in Kootenai County in 1930. The mill of the Caribou Mining Co. was rebuilt and new flotation machinery installed by the Coeur d'Alene Beauty Bay Mining & Milling Co. to treat custom ores from the Beauty Bay section, but no concentrates were shipped in 1930. Limited development was reported by the Great Western Copper Co., the Gray Wolf Mining Co., and the Silvertip Mining Co.

LATAH COUNTY

No ore or placer bullion was marketed from Latah County in 1930. The operator of the Easton mine in the Hoodoo district, which produced two cars of copper ore in 1929, shipped no ore in 1930 but reported 110 feet of tunnel work. A little development was also done at the Gold Bug E. mine.

LEMHI COUNTY

The value of the metals produced in Lemhi County was $63,588 in 1930, a decrease of $159,429 from 1929. Decreased metal production and low metal prices resulted in an output in 1930 that was less in value than any in the last 20 years. The output of copper from the Pope-Shenon mine, the largest producer in Lemhi County, was considerably less than that in 1929; and the Pittsburg-Idaho property, formerly a large producer of lead, was idle.

Eldorado district (*Salmon*).—The Harmony Mines Co. operated its property 8 miles northeast of Baker for about five months. The 150-ton flotation mill was run only 14 days; it treated 736 tons of copper ore containing chalcopyrite and pyrite, chiefly from production by lessees. The output of copper recovered from concentrates was only 34,564 pounds. In 1929 the mill treated more than 4,800 tons of ore, and the copper output was 187,822 pounds. About 150 feet of development was done at the property before it was closed. Articles[8] describing the mining and milling methods employed at the Harmony property were published in 1930.

Eureka district.—Two placers and three lode mines in the Eureka district produced 6,028 tons of ore, $1,001 in gold, 636 ounces of silver, 208,369 pounds of copper, and 5,780 pounds of lead, valued in all at $28,623, a decrease from $125,575 in 1929. The placer output was valued at $543. The Pope-Shenon mine 9 miles south of Salmon was again the chief producer in the district, but the output of copper was less than one-third of that in 1929. The property was operated by the Winder-Stillman Con, and the copper ore was treated in a 150-ton flotation plant; concentrates were shipped to a smelter near Tooele, Utah. A car of lead ore was shipped from the Red Cross mine, and a test lot of copper ore was marketed from the Sparetime prospect. Placer gold was shipped from the Specie Payment and McNutt properties.

Gibbonsville district.—A little gold ore from the Lick Creek (Golden Reward) mine, treated by gravity concentration, and about 40 tons of gold ore from the Big Four group, treated by amalgamation and concentration, produced small lots of concentrates which were shipped to Anaconda, Mont., for smelting. A little placer bullion, the remainder of the district output, was marketed from operations on Sheep Creek. About 300 feet of tunnel work was reported at the Tamroux prospect.

Gravel Range district.—A small lot of gold ore from development on the Rabbit Foot property was treated by pan amalgamation, and the resulting bullion was deposited at Boise.

Junction district (*Leadore*).—A shipment of 11 tons of lead ore from the Grizzly Hill property was the only production reported from the Junction district in 1930. The Kimmel & Sunset, Buckhorn, Dirigo, Copper Carbonate, and Homestake properties, all productive in 1929, were idle in 1930.

McDevitt district (*Tendoy*).—The mine and mill of the Tendoy Copper Queen Mining Co. were idle in 1930, but a car of copper concentrates from operations during the latter part of 1929 was shipped to a copper smelter near Tooele, Utah.

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[8] Gardner, R. D., Mining Practice at Harmony Mines Co., Baker, Idaho: Inf. Circ. 6240, Bureau of Mines, 1930, 8 pp.; Milling Methods and Costs at the Harmony Mines, Baker, Idaho: Inf. Circ. 6285, Bureau of Mines, 1930, 18 pp.

Mackinaw district (Leesburg).—Three placers in the Mackinaw district produced bullion valued at $1,972. Hydraulic operations were continuous at the Hockensmith placer on Arnett Creek from May until October, and bullion valued at about $1,250 was produced from the treatment of about 9,000 cubic yards of gravel. Most of the remainder of the district output came from hydraulicking about 2,000 cubic yards of gravel at the Leesburg-Bonanza property. A little bullion was also marketed from the Phelan Creek placers 6 miles south of Leesburg.

Mineral Hill district.—A little placer bullion was marketed from sluicing operations at the Fool Hen property 7 miles northwest of Shoup. The Clipper-Bullion property at Shoup, which produced rich gold ore in 1929, was idle in 1930.

Nicholia district.—Lessees operating the Viola mine shipped three cars of oxidized lead ore and reported development consisting of 70 feet of shaft sinking and 125 feet of drifting.

Pratt Creek district.—The Goldstone Mines Corporation operated its property on Pratt Creek continuously and treated about 1,000 tons of lead ore accumulated from development in the 100-ton table and flotation mill. Concentrates were shipped to Midvale, Utah, for smelting. A new Diesel engine was added to the power plant, and considerable development was done. A test lot of lead ore was shipped from the Virginia group on Sandy Creek.

Spring Mountain district.—A car of lead ore was shipped from the Self Starter property near Gilmore. The Spring Mountain Mining Co. continued development of the Big Windy property in 1930 by doing 316 feet of tunneling.

Texas district (Gilmore).—The output of the Texas district consisted of several cars of lead ore shipped by lessees from the Allie mine and a car of lead ore from the Tidal Wave property. The Pittsburg-Idaho property of the United Idaho Mining Co. has been idle since an explosion wrecked the power plant in 1929. The mine was a large producer of silver-lead ore from 1904 to 1928, and in both 1911 and 1912 it produced more than 12,000,000 pounds of lead.

Unorganized (Reno) district.—Two cars of oxidized lead ore were shipped from the Cabin mine, and 300 feet of tunneling was done.

OWYHEE COUNTY

The production of metals in Owyhee County was valued at $21,242 in 1930, a decrease of $8,282 from 1929. The difference was due chiefly to the decreased output of gold from the dredge near Triangle, operated by the American Gold Dredging Corporation. From 1863 to 1930 the county yielded $21,759,871 in gold and 24,628,583 ounces of silver, or a value of $40,751,243 for both metals. However, the production in the last 15 years has been small compared with the annual output prior to 1914.

Carson or French district (Silver City).—Ten lode mines in the Carson district produced 253 tons of ore yielding $5,079 in gold, 5,731 ounces of silver, and 33 pounds of copper, valued in all at $7,290, or an average of $28.81 in metals a ton. The output consisted of 4 tons of smelting ore, 29 tons of ore treated by amalgamation, and 220 tons of ore treated by concentration. All the material of concentrating grade was siliceous gold ore from the Neversweat mine, which was again the largest producer in the district. The property was operated by lessees, who treated the ore in a small mill using gravity and flotation concentration and shipped 2 tons of concentrates exceptionally rich in gold to Selby, Calif. Small lots of gold ore from the Independence, Village Blacksmith, Browney, and Gold Bug properties were treated by amalgamation; and test lots of gold ore of smelting grade were shipped from the Morning Star, King, and Hammond (Cosmopolitan) mines. A little exceptionally rich silver ore was marketed from the Alpine property by the Hoosier Leasing Co.

Castle Creek district.—Old silver tailings from former operations of the Pick & Shovel property were re-treated in a small cyanidation plant. The mill treated about 100 tons of these tailings, and the resulting silver bullion was shipped to Salt Lake City, Utah.

South Mountain district.—The Exploration Co. of California continued development at the Golconda property, a producer of lead ore in the early days of mining in Idaho, and reported the reopening of about 3,700 feet of old workings and 3,500 feet of new development, chiefly in drifting. Despite the large expenditure for development, which opened much ore of milling grade containing copper, lead, and zinc, no ore was mined or treated in 1930.

Steele district.—The American Gold Dredging Corporation was again the chief producer in Owyhee County. An electrically operated dredge having a daily capacity of 1,500 cubic yards treated about 250,000 yards of gravel from the Meadow Creek placer, and bullion valued at about $14,000 was marketed at Boise. The dredge was operated about six months; but a water shortage prevented work during June, July, and August, and the output was consequently much less than that in 1929.

SHOSHONE COUNTY

COEUR D'ALENE REGION

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, Idaho, 1929 and 1930, and total, 1884–1930, in terms of recovered metals

Year	Lode mines	Placers	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
			Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1929	44	2	[1] 1,971,580	[2] $10,556	8,776,726	1,320,700	283,115,336	86,092,294	$28,439,351
1930	38	4	[1] 1,794,929	[2] 11,648	8,831,461	1,569,882	258,621,960	66,290,478	19,728,887
Total, 1884–1930			(3)	7,170,733	255,273,837	81,632,093	[4] 4,208,917	815,262,102	720,564,854

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[1] Includes old tailings as follows: 1929, 41,133 tons concentrated and 36 tons sold to a smelter; 1930, 115,194 tons concentrated.

[2] Includes placer production as follows: 1929, $790 in gold and 3 ounces of silver; 1930, $1,425 in gold and 10 ounces of silver.

[3] Figures not available.

[4] Short tons.

The value of the production of metals in Shoshone County, which includes the Coeur d'Alene region, was $19,728,887 in 1930, or $8,710,464 less than the value in 1929, and was the lowest since 1922; the loss was mainly in the output of lead-zinc ore, which decreased more than 300,000 tons. The average total value of the ore and old tailings in 1930 was $10.99 in recovered metals a ton; and the value in gold and silver, chiefly silver, was $1.90 a ton. The kinds of ore (largely lead ore and lead-zinc ore with some copper-lead ore and zinc ore) and the contents of each kind have been given in preceding tables.

Most of the ore, as well as 115,194 tons of old tailings, was concentrated and produced 280,860 tons of concentrates, yielding on the average $66.02 in metals a ton. Sixteen milling plants, with a combined daily capacity of approximately 7,400 tons, were active during the year. Two of these mills used equipment for gravity concentration and flotation, and 14 were flotation mills without gravity equipment. There were exceptionally large decreases in the output of lead and zinc but small increases in gold, silver, and copper. The large decrease in lead from all concentrates made from lead-zinc ore offset an increase in lead from all concentrates made from lead ore. There was also a decrease in lead from crude lead ore of smelting grade. The three largest producers of lead and the largest dividend payers in Idaho—the Bunker Hill & Sullivan, Morning, and Hecla mines—are in Shoshone County, at Kellogg, Morning, and Burke. The statement to the county assessor gave $4,383,872 as the net profits of the Coeur d'Alene mines and leases in 1930, a decrease from $7,691,090 in 1929. The gross value of the ore and concentrates produced in 1930, as reported by the assessor, was $17,316,933, a large decrease as compared with $25,658,061 in 1929 and $23,799,205 in 1928.

For further details regarding the mining industry of Idaho, reference is again made to the annual report of the State mine inspector for 1930 (see p. 612) and to details of operations given in the latest Mines Handbook.[9]

Beaver district.—The output of the Beaver district consisted of one car of rich lead ore from the Tuscumbia mine, shipped to Kellogg for smelting, and a little gold bullion from two placer claims. The district output has been relatively unimportant since 1923 when operations were suspended at the Interstate-Callahan property of the Callahan Zinc-Lead Co.[10] north of Wallace. The printed report of the company continues:

> The old Interstate property, located at the head of Nine Mile, 7 miles northeast of Wallace, and comprising 1,030 acres, is a zinc property and has not been operated since the latter part of 1923 on account of the low price of zinc. We have kept men continuously at work doing the necessary repair work about the property.

A little tunnel work was reported by the Giant Mining & Development Co. and the Ray Jefferson Mining Co.

Eagle district (Murray).—The Jack Waite Mining Co., formerly the Jack Waite Consolidated Mining Co., continued operations at the Jack Waite group in Idaho and the adjoining Silver King group in Montana. The output in 1930 consisted of lead ore mined from both the Idaho and Montana sections of the mine. Several hundred tons of first-class lead ore containing more than 66 per cent of lead was shipped to Kellogg for smelting, and about 33,000 tons of lead ore from Idaho and Montana were treated in the company's old 150-ton flotation plant. The total production of lead was greater than that in 1929, but the output from the Idaho section was slightly less than that in 1929. Production from the eastern section of the property was credited to Sanders County, Mont. The property ranked tenth as a producer of lead in Idaho in 1930. During 1930 the lower or No. 2 tunnel, which was 4,600 feet long in December, was advanced 1,100 feet, and a 500-foot raise was begun, which will connect with the Silver King tunnel (1,820 feet long) driven from the Montana side. Work was also started on an inclined winze opening the vein system below the No. 2 tunnel level. Construction of a new 500-ton flotation plant was begun in October, 1930, and the mill was completed early in 1931. A short article [11] describing the new mill appeared in January, 1931. The plant is equipped with a sorting belt, where rich lead ore is separated by hand, and the mill is designed to make lead concentrates and zinc concentrates. The equipment includes a jaw crusher, a Traylor reducing crusher in closed circuit with a vibrating screen, an 8-foot by 48-inch Hardinge ball mill, and 8 by 24 foot Dorr classifier, Minerals Separation Sub-A type flotation machines, and two Oliver filters. A 2-mile tailings flume was built in 1930, which is designed to carry mill tailings to an impounding dam on Eagle Creek. Concentrates are hauled 1 mile by truck to the terminal of the rebuilt logging railroad. Placer bullion valued at about $1,200 was marketed from the Dunlop & Smith group prior to the sale of the property to the Jack Waite Mining Co. in May.

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[9] Rand, L. H., and Sturgis, E. B., The Mines Handbook: Suffern, N. Y., vol. 18, 1931, pp. 895–1150.
[10] Callahan Zinc-Lead Co. Ann. Rept. for year ended Dec. 31, 1930.

Evolution district.—Three lode mines in the Evolution district produced 148,326 tons of ore yielding $36 in gold, 2,311,420 ounces of silver, 397,801 pounds of copper, and 1,651,795 pounds of lead, valued in all at $1,024,237, or $6.91 in metals a ton. The district output of silver increased more than 37 per cent, but due to the decline in the average sale price the value of the output was slightly less than that in 1929. All the ore produced was of concentrating grade, chiefly copper-lead ore from the Sunshine (Yankee Boy) mine on the eastern side of Big Creek. The Sunshine mine was operated continuously during 1930, and the enlarged flotation mill treated nearly 150,000 tons of copper-lead ore rich in silver. Concentrates—about 3,900 tons—containing nearly 600 ounces of silver to the ton were shipped to the lead smelter at Bradley. The output of silver from the mine increased nearly 38 per cent, and the property became the leading producer of silver in Idaho in 1930; it ranked second in output of copper and produced a large quantity of lead. According to the company's annual statement [12] the income from ore sales amounted to $809,708, and the total income was $816,115. After total operating expenses of $581,548 were deducted a gross profit of $234,567 remained. The net profit, after $171,573 was deducted for depreciation, depletion, taxes, etc., was $62,994. Dividends amounting to $238,212 were paid during 1930, or a total of $868,212 to date. The surplus at the end of the year was $130,824. According to the figures given to the county assessor the company mined 145,719 tons of ore having a gross value of $809,708. The cost of extraction was $364,544, freight and treatment $79,377, and betterment and repairs $171,843; the net profit was $193,944.

The Sunshine mine is on Big Creek, the dividing line between Evolution and Yreka districts. The property is opened by five tunnels, the lowest of which (No. 5, also called Prize tunnel) is 3,000 feet long. Prior to 1930 the mine was operated through a 500-foot vertical underground shaft from the No. 5 tunnel and an inclined winze to the 1,300 level; but during 1929 the inclined winze was raised to the No. 5 tunnel, thus eliminating the use of the vertical shaft. In 1930 a new double-drum electric hoist was installed in the inclined shaft, which was deepened to the 1,700-foot level. The company reported 421 feet of shaft sinking, 1,992 feet of raising, and 4,170 feet of drifts and crosscuts, mostly on the 1,300 level. Ore reserves of about 270,000 tons were reported early in 1930, and they were greatly increased during the year by development on the 1,300-foot level. The property is equipped with a flotation mill, the capacity of which was raised to about 500 tons a day during 1930 by the addition of a new 8-foot by 48-inch Hardinge ball mill and a 6 by 22 foot Dorr classifier. Minerals Separation flotation machines are used, and the concentrates are filtered on an 8-foot Oliver machine.

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[11] Mining Truth, Jan. 8, 1931, p. 11.

[12] Sunshine Mining Co. Ann. Rept. for year ended Dec. 31, 1930.

The Charles Dickens mine of the Dickens Consolidated Mines Co. was idle during 1930, but one car of lead concentrates produced from ore treated in the company's 150-ton flotation plant late in 1929 was shipped to Bradley for smelting. The property is on Moon Creek about 3 miles north of Shont and produced considerable lead ore of milling grade in 1929. The remainder of the district output consisted of one car of lead ore of milling grade from the Western Union mine, shipped to the Hercules custom mill.

Mine development was reported by several companies that were active in the Evolution district in 1930. About 350 feet of shaft sinking and drifting was done by the Coeur d'Alene Crescent Mining Co.; a new electric power line was constructed, a 3-drill compressor was installed, and 250 feet of tunnel work was done at the Sterling group by the Metropolitan Mines Corporation; and more than 2,200 feet of drifting and crosscutting was done at the Coeur d'Alene-Jumbo group by the Stratton Silver Summit Mining Co. The Lincoln Mining Co. did 400 feet of drifting at the Silverado property, and the New Hope Mining Co. and the Silver Basin Consolidated Mining Co. did a little work at their properties.

Hunter district (*Mullan*).—Seven lode mines in the Hunter district produced 498,745 tons of ore yielding $5,908 in gold, 1,476,168 ounces of silver, 224,284 pounds of copper, 68,389,181 pounds of lead, and 42,764,189 pounds of zinc, valued in all at $6,075,530, or $12.18 in metals a ton. The output from this district in 1930 was more valuable than that from any other district in Idaho except Yreka. It consisted of 261 tons of first-class ore and of 498,484 tons of concentrating ore which was reduced to 91,612 tons of concentrates, compared with 5,169 tons of first-class ore and 676,174 tons of concentrating material in 1929. The value of the district output declined $4,013,891, or nearly 40 per cent, from that in 1929 due to the closing of the Star, Gold Hunter, and Golconda mines and to the curtailment of output at the Morning mine.

The Morning mine of the Federal Mining & Smelting Co. ranked first as a producer of zinc, second as a producer of lead, and fourth as a producer of silver in Idaho in 1930. As in the past, lead ore and concentrates were shipped to East Helena, Mont., and zinc products to the electrolytic plant at Great Falls or Anaconda, Mont. The mine is opened by a vertical shaft 2,984 feet below the main adit level, by 31,848 feet of drifts, and by a main adit tunnel 10,000 feet long. More than 3,200 feet of development in drifting, crosscutting, and raising was done in 1930, and the vertical shaft was sunk an additional 134 feet. The ore body was opened for its full length on the 3,250-foot level and for 590 feet on the 3,450-foot level; the vein was opened by a crosscut on the 3,650-foot level and was found to be of normal width and to contain ore of average grade.

An article[13] describing mining methods at the Morning mine appeared early in 1930. The flow sheet of the 1,200-ton mill was completely changed in 1927, and the plant has since been run as a selective flotation mill. An article[14] describing the revised milling methods appeared in 1930. Since these improvements were made the metal content of both the lead concentrates and the zinc concentrates has gradually increased. The company, which also operated mines in Kansas, Missouri, and Oklahoma, paid dividends amounting to $239,888 in 1930, or a total of $24,187,966 to date, and had a surplus of $7,136,691 at the end of the year.

According to the figures given to the county assessor the company extracted from the Morning mine 362,628 tons of ore, which had a gross value of $4,748,014. The cost of extraction was $2,071,073, freight and treatment $1,758,726, and betterment and repairs $6,510; the net profit was $911,705. The printed annual report of the Federal Mining & Smelting Co. for 1930 gives the following data.

> The Morning and Page mines, which, if shut down, would incur a heavy fixed expense, were operated at reduced capacity. This general policy of reduced production will be followed as long as the low metal prices continue.
>
> The earnings of the Morning mine amounted to $766,090.96, a decrease of $1,180,894.62 from 1929.
>
> The ore mined amounted to 361,372 tons, a decrease of 19,288 tons from the 1929 tonnage.
>
> The average grade of the ore was 9.0 per cent lead, 3.4 ounces silver per ton, and 6.5 per cent zinc.
>
> Further improvement was made in the grade of concentrates. Lead concentrates now assay around 74 per cent lead and zinc concentrates around 56 per cent zinc.
>
> Ore reserves at the end of the year were estimated at 1,720,700 tons of developed ore, a gain of 67,500 tons over the estimated tonnage at the end of 1929. "Possible ore" is not taken into consideration, but there is no doubt that much additional tonnage will be developed as the deeper levels are reached.

From 361,372 tons of lead-zinc ore of milling grade the company made lead concentrates containing 992,322 ounces of silver and 58,294,086 pounds of lead and zinc concentrates containing 271.29 ounces of gold, 174,003 ounces of silver, 2,047,785 pounds of lead, and 40,435,993 pounds of zinc. Lessees also produced 254 tons of first-class lead ore of smelting grade and 642 tons of lead-zinc milling ore that contained 18,722 ounces of silver, 318,794 pounds of lead, and 100,624 pounds of zinc.

The Gold Hunter Mines (Inc.) operated its mine and 500-ton flotation mill until July 3, when both were closed on account of the low price of silver and lead. The company shipped about 5,600 tons of silver-lead concentrates to the Bunker Hill smelter at Bradley, a decrease of more than 2,200 tons from the 1929 output. The mine is opened by two vertical shafts, one 1,200 feet deep and the other

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[13] Wethered, C. E., and Coady, L. J., Mining Methods at the Morning Mine of the Federal Mining & Smelting Co., Mullan, Idaho: Inf. Circ. 6238, Bureau of Mines, 1930, 13 pp.

[14] Dalton, M. P., and Price, G. S., Milling Practice at the Morning Mill: Min. Cong. Jour., vol. 16, No. 1, January, 1930, p. 25.

400 feet deep, as well as drifts and raises approximating 10 miles; no development was done in 1930. The mine ranked seventh as a producer of lead in Idaho in 1930 and tenth as a producer of silver. Further details of operations in 1930 were not made public.

Development of the Star mine was continuous throughout the year, but production of ore was suspended during April. The mine is operated by the Sullivan Mining Co., the stock of which is owned jointly by the Hecla Mining Co. and the Bunker Hill & Sullivan Mining & Concentrating Co. The output in 1930 amounted to about 33,000 tons of lead-zinc ore, compared with about 114,000 tons treated in 1929. The output of zinc decreased more than 8,000,000 pounds from that in 1929, and the mine dropped from second to fifth place in output of zinc in Idaho. The output of lead from the Star property decreased more than 5,000,000 pounds, and the mine ranked twelfth instead of sixth as in 1929. The property is opened by a 10,000-foot crosscut from the 2,000-foot level in the Hecla mine; 2,066 feet of development in crosscuts, drifts, and raises was done in 1930. The following paragraphs are taken from the report of the Hecla Mining Co. for 1930.

> Because of these low metal prices production from the Star mine was discontinued during April, 1930, and the electrolytic zinc reduction plant of the Sullivan Mining Company put on a curtailed basis taking its supply of zinc from the Hecla mine, the Bunker Hill mine, and other custom sources. The Star mine, like the zinc reduction plant, is owned by the Sullivan Mining Co., in which we have a 50 per cent interest. Bunker Hill brand electrolytic zinc produced by the Sullivan Mining Co. continues in comparatively good demand; current sales exceed the present limited production. At the low zinc price ruling there is no inducement to push sales; our regular customers are cared for and because of its fine quality some new business is being developed. Production of cadmium, an important by-product metal, was begun May 1, from the accumulation of purification residues. This metal is of high quality and is well received by the trade; here, too, there is no inducement to push sales because of the low price for cadmium.
>
> Development work was continued at the Star mine from the time of suspension of ore production until the end of the year. This work is now being gradually reduced and the work will, within 60 days, be confined to a small crew to keep the mine in condition for resumption of work when metal prices justify resumption.

The mine and 250-ton flotation mill at the Hector & Mayflower property were operated at capacity by Golconda Lead Mines until March 15, when production was suspended due to low metal prices. Development was continuous throughout the year; and the mill was operated on a 1-shift basis during September, November, and December on ore from development. The output from the mine decreased from about 65,500 tons in 1929 to about 21,000 tons in 1930 and resulted in a decrease of more than 4,700,000 pounds of lead and about 3,500,000 pounds of zinc; there was also a large decrease in silver output. Despite the marked decrease in production the property ranked eleventh in output of zinc and sixteenth in output of lead in Idaho in 1930. The mine is opened by the 5,000-foot Mayflower tunnel, an 800-foot inclined raise and a vertical underground shaft 800 feet deep (both from the Mayflower tunnel level), and about 5,000 feet of drifts and crosscuts. During 1930 the main underground shaft was sunk to the 1,800-foot level, and about 2,000 feet of lateral development was done. A new hoisting plant with a capacity of 400 tons a day was placed in operation in the main shaft in February. The ore body on the 1,400-foot level was opened for 800 feet, and drifting on the vein on the 1,600-foot level was in progress at the end of the year. The company secured an option on the adjoining Square Deal property of 10 claims, and a long drift was started on the 1,400-foot level. According to the statement to the county assessor, the company extracted 21,065 tons of lead-zinc ore having a gross value of $189,753. Extraction costs were $98,926, freight and treatment $95,712, and betterment and repairs $8,084—a net loss of $12,969.

The Atlas Mining Co. shipped several hundred tons of lead ore to the Gold Hunter mill, which it operated on a rental basis; one car of lead concentrates was shipped to the lead smelter at Bradley. New surface buildings were erected at the Atlas property, and a 1,400-foot aerial tramway was constructed from the mouth of the tunnel to the Gold Hunter mill. The ore was mined while a new ore body opened at a point 9,000 feet from the portal of the Atlas tunnel was being developed. A small lot of first-class lead ore was shipped from the Vindicator property.

No output was reported from the Independence and American Commander groups adjoining the Morning mine, but the Independence Lead Mines Co. sank a 100-foot vertical shaft and did about 300 feet of tunnel work in 1930. The Butte & Coeur d'Alene Development Co. reported 300 feet of tunnel work at the Donovan group during the year; and the Granada Lead Mines (Inc.), organized in 1930 to explore ground adjacent to the Golconda property, completed the erection of a surface plant and started work on a new tunnel.

Lelande district (*Burke, Mace, Frisco*).—Six lode mines and one old tailings dump in the Lelande district produced 317,432 tons of ore and 807 tons of old tailings which yielded $41 in gold, 1,837,536 ounces of silver, 330,768 pounds of copper, 64,029,672 pounds of lead, and 4,643,851 pounds of zinc, valued in all at $4,174,881, or $13.12 in metals a ton. The output consisted of 18,095 tons of first-class ore and of 299,337 tons of concentrating ore which, with 807 tons of old tailings, was reduced to 49,730 tons of concentrates. The value of the district output decreased $1,671,736 from that in 1929, due chiefly to the decline in metal prices but partly to the decrease in the production of lead and zinc.

The Hecla Mining Co. at Burke, which shipped first-class lead ore and lead concentrates to the Bunker Hill smelter at Bradley and zinc concentrates to the electrolytic plant of the Sullivan Mining Co. at Silver King, was the largest producer in the district. The mine is opened by a 3,040-foot vertical shaft and various drifts, and 5,457 feet of development was done in 1930. About 2,004,808 tons of ore is said to be in reserve. An article [15] describing the mining methods at the property was published in 1930. The 750-ton concentration plant at Gem was operated regularly, as well as the flotation plant for the re-treatment of jig tailings. The company ranked third as a producer of lead and silver in Idaho in 1930 and produced considerable zinc. The dividend rate was increased in 1930, the company paying $1,000,000 as compared with $900,000 in 1929; the total dividends paid to date amount to $19,705,000.

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[15] Foreman, C. H., Mining Methods and Costs at the Hecla and Star Mines, Burke, Idaho: Inf. Circ. 6232, Bureau of Mines, 1930, 21 pp.

Of the ore mined, 235,413 tons were milled at Gem in the company's 750-ton mill equipped for gravity and flotation, making 38,761 tons of concentrates which, with 17,443 tons of crude ore and 773 tons of lessees' ore, contained 1,560,323 ounces of silver, 57,502,397 pounds of lead, and 1,440,726 pounds of zinc. The published reports of the company state that the output of the Hecla mine for 27 years was 959,625 tons of crude ore and concentrates containing 27,022,347 ounces of silver, 972,099,519 pounds of lead, and 3,822,014 pounds of zinc.

According to the figures given to the county assessor a total of 311,684 tons of ore and waste was extracted in 1930, which had a gross value of $3,395,134. The cost of extraction was $1,281,274, freight and treatment $888,965, and betterment and repairs $17,214; the net profit was published as $1,207,681. After $1,424,617 was paid for various expenses and $122,163 deducted for depreciation the company paid $116,010 in taxes and $1,000,000 in dividends. The expenditures exceeded the income in 1930, and the company drew $38,784 from surplus. At the end of 1930, however, the company had a surplus of $5,596,302.

The Hercules Mining Co. operated its 800-ton custom flotation plant at Wallace continuously until March 15, when ore receipts stopped due to the suspension of mining at the properties of the chief shippers. The plant treated about 83,000 tons of custom ore in 1930, compared with 195,300 tons in 1929. Ore was received from 13 properties; the Dayrock, Sherman, and Tamarack & Custer mines were the chief contributors. No important changes were made in the milling plant, which is described in the report of the mine inspector of Idaho for 1929.

The Sherman Lead Co., controlled by the Day interests, shipped nearly 30,000 tons of lead ore to the Hercules mill before March 15, when it was closed. The output of ore from the property decreased from more than 49,000 tons in 1929, and there were corresponding decreases in the output of silver and lead. In 1930 the property ranked sixth in output of lead and eighth in silver in Idaho. According to a statement to the county assessor the mine produced 29,847 tons of ore having a gross value of $189,427. Cost of extraction was $113,024, freight and treatment $4,683, and betterment and repairs $20,830—a net profit of $50,890. The company paid its initial dividend of 1 cent a share, or a total of $36,750, on March 31. The property is operated through the No. 5 Hercules tunnel, which is 5,800 feet long, and is opened by various drifts and crosscuts on seven levels from a 1,000-foot inclined raise from the No. 5 tunnel. In 1930 development, which was said to have opened much new ore, consisted of 653 feet of raises and nearly 1,700 feet of drifts and crosscuts. No statement of ore reserves was made. The following notes are taken from the company's annual statement.[16]

> The Sherman mine, located a short distance northwest of the town of Burke, Idaho, is reached through 5,800 feet of tunnel in Hercules and Humming Bird ground, leased jointly from these two mining companies. Surface facilities are rented from the Hercules, including compressor, generator, steel sharpening shop, change houses, machine shop, blacksmith shop, electric shop, carpenter shop, sorting plant, bins, and yard; also main haulage ore cars, coaches, and trolley motors. The Sherman Company owns all the equipment in the mine proper, and in this respect has a complete modern outfit.

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[16] Sherman Lead Co. Ann. Rept. for 1930.

The mine product is sold outright to the Hercules custom mill at Wallace, upon advantageous terms. Following a series of extensive metallurgical experiments in 1929, the mill was able during the past year to treat a considerable tonnage of oxidized lead ore which came from the upper workings.

Several cars of lead ore were shipped to the Hercules mill by lessees operating parts of the Ambergris and Hercules mines. The Humming Bird mine, a producer of about 5,700 tons of lead-zinc ore in 1929, was idle in 1930.

The Hull Leasing Co. continued operations at the Frisco mine of the Federal Mining & Smelting Co. and shipped several hundred tons of lead-zinc ore to the Hercules mill. The company also treated several thousand tons of lead-zinc ore in its 75-ton flotation plant near the Hecla mill and shipped about 1,800 tons of lead concentrates to East Helena, Mont., and nearly 3,400 tons of zinc concentrates to Anaconda and Great Falls, Mont., for treatment. According to a statement to the county assessor the Hull lease produced 25,850 tons of ore valued at $114,370. The cost of extraction was $56,519 and freight and treatment $40,077; the net profit was $17,104. The mine again ranked seventh as a producer of zinc in Idaho and was also a large producer of lead. The Mace mine of the Federal Mining & Smelting Co., which produced more than 600 tons of ore in 1929, was operated in 1930 by lessees who shipped one car of lead-zinc ore to Butte, Mont., for milling. The remainder of the district output consisted of several hundred tons of old zinc tailings from Canyon Creek, shipped by lessees to the Hercules mill.

The Ajax Mining Co. reported 2,200 feet of drifting at the Ajax mine during 1930, but no ore was marketed. The Mutual Mines Development Co., engaged in 1930 in developing the Formosa and Deep Wonder groups in the Lelande and Hunter districts, reported 1,350 feet of drifting on the vein in Lelande district. The property is opened by a 2,010-foot tunnel from the Canyon Creek side, and lead ore of commercial grade was opened in 1930 in a vertical winze 150 feet below the main tunnel. Late in the year a 100-ton flotation plant on Canyon Creek was being constructed by the Mutual Mines Development Co.

Placer Center district (*Sunset*).—Five lode mines in the Placer Center district produced 62,910 tons of ore yielding 342,935 ounces of silver, 79,546 pounds of copper, 9,079,669 pounds of lead, and 2,223,922 pounds of zinc, valued in all at $703,102, or $11.18 in metals a ton. All the output was ore of concentrating grade; it was reduced to 10,653 tons of concentrates. The value of the district output declined nearly 63 per cent from that in 1929, due to the closing of the Tamarack & Custer mine and the lessened output from the Dayrock and Galena properties.

The Dayrock Mining Co. operated its property in Nine Mile Canyon the entire year and shipped lead ore of milling grade to the Hercules flotation plant at Wallace. The property was the largest producer in the Placer Center district, and the output even exceeded that from the Tamarack & Custer mine; it ranked fifth in production of lead and seventh in silver in Idaho in 1930. The mine was operated on a 2-shift basis until March, when the declining metal prices forced a curtailment in output and operations were continued on 1 shift only. The output in 1930 was considerably less than that in 1929 and consisted of 29,987 tons of milling ore containing 262,948 ounces of silver and 6,441,624 pounds of lead. According to a statement to the county assessor the ore had a gross value of $241,431. The cost of extraction was $129,303, freight and treatment $4,569, and betterment and repairs $2,372; the net profit was $105,187. Dividend 5, 3 cents a share or $50,829 in all, was paid on March 31, making a total disbursement of $253,905 to date. The mine is 3 miles north of Wallace on the west side of Nine Mile Canyon and is opened by a tunnel 1,450 feet long, an inclined underground shaft 460 feet below the tunnel level, and various drifts and crosscuts on four levels. Development in 1930 consisted of 1,687 feet of drifts and crosscuts and 953 feet of raises. Ore reserves were said to have been greatly increased by recent development. The following paragraphs are taken from the printed annual report of the Dayrock Mining Co. for 1930.

During the summer of 1930 the property of the California Consolidated Mining Co. was acquired, consisting of an old mill building with water rights, two patented mill sites, and three patented lode claims. In the fall two patented claims were purchased from the Option Mining Co.

The treasurer's report shows quick assets (equivalent of cash on hand) of $37,470 on December 31, 1930. The net income for the year before the deduction of Federal taxes and depletion was $88,405.

The ore is trammed by storage battery locomotive along the upper level from the shaft, about 1,000 feet underground, to the crushing plant on the surface. It is then loaded in railroad cars and shipped to the Hercules custom mill at Wallace for concentration. The mine product is sold outright to the mill under the terms of a favorable schedule.

No important additions were made in 1930 to the surface plant or to the underground equipment. The improvements of the previous year, consisting of new yard facilities complete with larger change house, steel building to house new compressor and blacksmith shop, timber shed with cut-off saw and skidways, powder house, and storage battery locomotive with generator panel, were found not only to be extremely satisfactory in performance but sufficient in size for all demands at the present scale of production.

In March a substantial decrease in the price of silver and lead, the two metals produced by the Dayrock Mining Co., necessitated a reduction in output. This was met by laying off the night shift. A few months later the production was again decreased by cutting the crew to about 33 men working six days a week.

The Dayrock property now consists of 35 patented claims and 19 unpatented claims within which are included the Dayrock, Panhandle, Monarch, Black Cloud, Option, and California groups, as compared with three unpatented claims of the original McPhillips group, under lease and bond, when control of the property passed to the present management in 1924.

On the main haulage level east of the McPhillips fault, the ledge was followed 87.5 feet easterly. The vein was very narrow; no commercial ore was developed by this drift. On the 200 level east, 242.1 feet of drifting and crosscutting with one raise 21.5 feet in length failed to disclose the downward continuation of the ore. Consequently, a prospect winze was begun on the 100 east in the vicinity of No. 20 chute; it was down 22.6 feet at the end of the year.

Stoping was carried on continuously throughout 1930. Two blocks of fair ore were extracted on the 100 level; one on the west side of the McPhillips fault, and the other (the better of the two) on the east side. On the 200 level west a small tonnage was removed, which lay against the Haff fault. Good ore was left in the pillar required at this point to protect the shaft.

The major part of the mine's production came from the stopes on the 300 level west. On this level the entire block from No. 21 to No. 39 chute, with the exception of three small pillars, was mined out. At the end of the year ore breaking was proceeding on excellent ore of very good width in the vicinity of chutes 39 and 41.

In 1930 the output from the Tamarack & Custer mine, which had been the leading producer in the district since 1924, was less than one-fourth that in 1929. Stoping operations were suspended in March; but development was continued throughout the year, and some ore from development was shipped intermittently to the custom flotation mill of the Hercules Mining Co. The output consisted of 20,334 tons of ore containing 53,004 ounces of silver, 2,672,947 pounds of lead, and 2,757,345 pounds of zinc, compared with an output of 83,922 tons of ore containing 243,474 ounces of silver, 11,059,366 pounds of lead, and 10,492,276 pounds of zinc in 1929. In 1930 the mine ranked ninth in production of zinc and fifteenth in lead in Idaho. During 1930 the property was operated through the No. 7 tunnel from the Canyon Creek side. The tunnel is 11,500 feet long and is connected with the upper workings, formerly operated from Sunset, by a 1,200-foot raise. Development in 1930 consisted of 2,397 feet of drifts and crosscuts, 447 feet of raises, and 187 feet of shaft work. According to a statement made to the county assessor the ore had a gross value of $93,260. The cost of extraction was $172,980, freight and treatment $3,156, and betterment and repairs $20,286; the operating deficit was $103,162. The following paragraphs are taken from the company's annual report.[17]

> All mining operations are now carried on through the No. 7 crosscut, 6,600 feet long, the portal of which is at Dorn, Idaho, about 5 miles up the Burke Canyon northeasterly from Wallace. The ore is hauled out this adit level from the main loading stations approximately 7,500 feet from the surface.
>
> The mine run is crushed and sorted at the surface and the resultant product sold outright under the terms of a favorable schedule to the Hercules custom mill at Wallace. The Tamarack ore is considered rather refractory, and very fine grinding is required for successful differential flotation of the lead and zinc minerals. The results secured at the Hercules mill are quite satisfactory.
>
> At the close of 1929 the operating base had just been changed from No. 5 on the hill to No. 7 in the canyon. During the past year this transfer was finished, and complete facilities were provided at No. 7 for the mining operations. This included the alteration and rehabilitation of the sorting plant, the installation of a new 4-inch pipe line to provide a better water supply and improved fire protection, and various other minor improvements. The main haulage rolling stock was completely overhauled and placed in first-class condition.
>
> The Frisco mill was completely dismantled, and all of the machinery and the equipment (save two sets of rolls and the boiler) were moved to the Hercules plant at Wallace for more convenient storage.
>
> In the fall the power available in the Frisco mill water right was utilized by the installation of a 2,300-volt generating plant and the erection of a 3-phase copper line to the No. 7 works.
>
> In March, 1930, the company was forced to cease stoping because of the low prices of silver, lead, and zinc. The crew was accordingly greatly reduced at that time. Development work was continued during the following months until November 1, when the persistent decline in the metal market caused its suspension. During this latter period some mill feed was produced from the drifts on the 1,350 level of the Chesapeake vein.
>
> Stoping was in progress only during January, February, and part of March. During this time a new stope was started on the south vein on the 400 level east. The first round was taken from along the back over a distance of 240 feet. In the 600 south shrinkage stope the old fill was extracted and sorted for mill feed up to the ninth floor where previous ore breaking had been discontinued; the stope was timbered, and one cut 65 feet in length was taken along the back.

Operations were continuous at the Galena mine of the Callahan Zinc-Lead Co. on a 1-shift basis throughout the year. Most of the ore treated in the company's 200-ton flotation plant came from development operations, chiefly on the new Parallel vein. The output of lead and silver from the Galena mine has declined steadily since the record output in 1927. In 1930 the output consisted of about 11,600 tons of silver-lead ore which was reduced to about 850 tons of concentrates (sold to the smelter at East Helena, Mont.).

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[17] Tamarack & Custer Consolidated Mining Co. Ann. Rept. for year ended Dec. 31, 1930.

According to the company's annual report[18] the concentrates had a value of $50,636, and the extraction and treatment costs were $131,367—an operating deficit of $80,731. After crediting miscellaneous income the net loss, exclusive of depletion and depreciation, was $65,910. The surplus at the end of the year was $257,872. The report continues:

> The Galena property consists of 99 lode mining claims, or approximately 1,620 acres, starting from the city limits of Wallace and extending westerly about 2½ miles. Our mining equipment is heavy-duty and efficient. The mill is of the latest type flotation unit, and its present capacity is 200 tons per day. With a few slight changes the present capacity can be doubled. Extensive exploration and development work has been done by us on this property as shown by the following footage: Shafts and raises, 3,207 feet; crosscuts and drifts, 20,372 feet; total, 23,579 feet.
>
> The vein has been developed to a depth of approximately 1,620 feet by shafts and levels opened up at 200-foot intervals. On the different levels we found the vein to be strongly mineralized from the grass roots down to the lowest level, although the better grade or mineable ore occurs in irregular bunches or lenses. From these lenses there was mined a total of 112,988 tons of ore.
>
> The Parallel vein, lying approximately 275 feet to the south of the Galena vein, was first disclosed by diamond drilling from the east drift of the Galena vein on the 600 level. Later a crosscut was driven disclosing a strong vein with 8 feet of ore, assaying 9.4 per cent lead and 6.3 ounces silver at the point where the crosscut entered the vein. In many respects the structure and character of the vein are similar to the Galena vein, the better grade of ore occurring in irregular lenses, the same as disclosed in the former vein, although there is a noticeable difference in the character of the ore. It is practically free from zinc and shows a higher silver content. There were two shoots of ore exposed on this level, each approximately 100 feet in length.
>
> Since this vein was developed on the 600 level it has been opened up on the 800 and 1,000 levels and shows ore conditions to be practically the same on both levels as were disclosed on the 600 level above. On the 1,000 level, which is 400 feet below the 600, two shoots of ore were exposed, each approximately 100 feet in length. A sample taken across 6½ feet in a certain part of the vein assayed 7.8 per cent lead with 6.9 ounces of silver. A total of 22,193 tons of ore has been mined from the ore exposed in the Parallel vein on the 600, 800, and 1,000 levels.
>
> A crosscut is now being driven from the 1,200 winze level that will cut the Parallel vein 200 feet below the ore exposed on the 1,000 level. It is possible to prospect the Parallel vein from this winze to the additional depth of 400 feet below the 1,200, which would give us a total depth of 1,000 feet below the 600.
>
> All of our work at the present time is confined to developing the Parallel vein at depth; and we have just started an extensive diamond drilling program for the purpose of prospecting the eastern extension of the Galena vein, a portion of the vein that has a very good showing of ore but has not been explored below the 600 level. The drilling will be done from the different levels of the Parallel vein below the 600 level.
>
> Mining and milling was started in October, 1926, and since then to the present date a total of 135,181 wet tons of ore has been mined from the Galena and Parallel veins. An average of the daily assays of the mill heads for the above tonnage delivered to the mill assayed approximately 5.2 per cent lead and 4 ounces in silver. From this ore a total of approximately 11,595 dry tons of high-grade lead-silver concentrates was produced and shipped to the smelter.

The Success mine, formerly a large producer of lead-zinc ore, was operated by lessees during 1930, and several hundred tons of lead-zinc ore were shipped to the Hercules mill. The property is controlled by the Day interests, and it was reported that during 1930 the mine plant and old 300-ton mill were dismantled.

The Associated Mines Co. was organized in 1930 to take over the Rex and Red Monarch groups, formerly operated by the Delaware Mines Corporation. It is proposed to refinance the organization and extend the 5,900-foot Red Monarch tunnel to the Rex vein. During 1930 lessees shipped two cars of lead-zinc ore from the old Rex mine to the Hercules mill at Wallace, and about 275 feet of development was reported. The Blue Wing Mining Co. did about 1,000 feet of tunnel work, and a little drifting was reported by the Nine Mile Mining Co.

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[18] Callahan Zinc-Lead Co. Ann. Rept. for year ended Dec. 31, 1930.

St. Joe district.—A little placer bullion was marketed from a property in the St. Joe district in 1930. A total of 135 feet of tunnel work was reported by the Idaho Star Mining Co.

Summit district (*Murray*).—Four lode mines in the Summit district produced 973 tons of ore yielding $121 in gold, 4,940 ounces of silver, 1,324 pounds of copper, 266,949 pounds of lead, and 66,666 pounds of zinc, valued in all at $18,742, or $19.26 in metals a ton. Most of the ore from the district was lead ore of milling grade from the Cedar Creek property east of Murray. The new 100-ton flotation plant operated intermittently for two months and treated 756 tons of lead ore, making 151 tons of lead concentrates. This product, which contained 4,498 ounces of silver and 161,769 pounds of lead, was shipped to Bradley for smelting. The property was operated by the Cedar Creek Mining & Development Co. (Ltd.); 480 feet of drifting in the No. 3 tunnel opened a new ore body at a depth of 520 feet. A lessee operated the Terrible Edith property of the Pontiac Mining Co. and shipped 115 tons of lead-zinc ore to the Hercules flotation mill. A small lot of lead concentrates was shipped from the Giant Ledge property near the Cedar Creek mine, and a car of sulphide lead ore was shipped from the Bear Top mine.

Yreka district (*Kellogg*).—Nine lode mines and one tailings dump in the Yreka district produced 631,506 tons of ore and 114,387 tons of old tailings yielding $2,833 in gold, 2,843,258 ounces of silver, 514,143 pounds of copper, 111,719,100 pounds of lead, and 16,591,850 pounds of zinc, valued in all at $7,546,690, or $10.12 in metals a ton. The value of the district output declined $1,594,979 or more than 17 per cent from that in 1929, but the decline was due entirely to the lower average prices of silver, copper, lead, and zinc, as the output of each of the five metals increased slightly. The value of the district output exceeded that of every other mining district in Idaho in 1930. It consisted of 3,306 tons of first-class smelting ore and of 628,200 tons of milling ore which, with 114,387 tons of old tailings, yielded 122,282 tons of concentrates.

The Bunker Hill & Sullivan Mining & Concentrating Co. operated its mine at Kellogg continuously; the West or main mill of 1,300 tons capacity was operated on Bunker Hill ore, and the 500-ton South or Star mill on Star ore and old tailings from the Bunker Hill mine. The 200-ton Sweeny mill was operated the entire year on complex lead-zinc ore received from custom shippers, chiefly the Sidney mine in the Pine Creek area. A publication [19] describing the milling methods of the West, South, Sweeny, Crescent, and Deadwood mills appeared in 1930. The company controls the operations of several mining properties in the vicinity, including the Crescent, Caledonia, and Sierra Nevada mines. In 1930 the Bunker Hill & Sullivan property was the largest producer of lead in Idaho, ranked second as a producer of silver, and third as a producer of copper and zinc. According to the company's printed report for 1930 the mine produced 455,475 tons of ore, which was reduced to 88,467 tons of concentrates containing 1,767,576 ounces of silver, 87,264,115 pounds of lead, and 10,226,816 pounds of zinc. This output, however, does not include the first-class smelting ore shipped from the Bunker Hill property and the lead ore mined by lessees and shipped to the Sweeny custom mill. At the various plants near Kellogg the company mines, mills, and smelts its ore and concentrates; refines its bullion; and disposes of fine gold and silver, pig lead, and antimonial lead. With the addition of the new electrolytic zinc plant at Silver King the company, through its subsidiary, also marketed exceptionally fine zinc, and with the completion of an electrolytic cadmium plant early in 1930 the company also marketed cadmium. The new electrolytic cadmium plant was described in the report of the mine inspector of Idaho for 1930. The Bunker Hill & Sullivan property is opened by the 18,000-foot Kellogg tunnel, which intersects the mine workings nearly 1,800 feet below the outcrop. From this tunnel there are two inclined underground shafts to the 1,900-foot level; about 7,700 feet of development was done in 1930. An article [20] describing mining methods used at the Bunker Hill roperty was printed early in 1931.

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[19] Handy, R. S., Milling Methods and Costs at the Northern Idaho Mills of the Bunker Hill & Sullivan Mining & Concentrating Co.: Inf. Circ. 6314, Bureau of Mines, 1930, 53 pp.

According to the figures given to the county assessor, the company extracted 455,475 tons of ore (excluding lessees' ore), which had a gross value of $5,943,747. The cost of extraction was $1,998,110, freight and treatment $2,289,223, and betterment and repairs $45,051. The net profit was $1,611,363, the largest of any mining company in Idaho. Dividends aggregated $2,109,690 in 1930, or a total of $47,891,242 paid since 1890.

The ore milled on company account was reduced to 88,467 tons of concentrates, which contained 49.32 per cent of lead, 5.78 per cent of zinc, and 19.98 ounces of silver to the ton. The ratio of concentration was 5.15 to 1, and the costs per ton mined were as follows: Mining, $3.841; concentrating, $0.945; shipping, $0.03; other costs, $0.35; a total of $5.166. From 1886 to the end of 1930 the company has mined 13,465,420 tons of ore having a gross value of $162,559,496. Net smelter returns were $100,693,438, and operating profit was $55,452,781.

The Bunker Hill smelter and refinery ran continuously in 1930, largely on ore and concentrates from the Bunker Hill and Hecla mines but partly on custom ore from Western States, Alaska, and British Columbia. The output of the smelter in 1930 was 84,405 tons of lead, 10,272,081 ounces of silver, and 46,000.5 ounces of gold from purchased ores, compared with 69,295 tons of lead, 8,544,009 ounces of silver, 1,209,789 pounds of copper, and 35,888 ounces of gold in 1929. The smelter output in 1930 was larger than that in any year since the plant was built. The increase in the smelter output did not indicate a serious change in the output of the mine but was due to the fact that the smelting contract with the American Smelting & Refining Co. expired early in 1930, after which the Bunker Hill smelter took care of all the lead concentrates from the various mills. Additional notes from the company's annual report follow.

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[20] Brown, C. E., Mining Methods of the Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho: Inf. Circ. 6407, Bureau of Mines, 1931, 11 pp.

The drastic decline in the prices of lead, silver, and zinc which began late during 1929 has continued ever since with slight and temporary interruptions, until the present combined price is lower than our operations have heretofore known. These low price conditions resulted in receipts from sale of 1930 mine produce close to a million dollars less than for 1929.

Mine development was continued vigorously throughout the year. An additional level, 200 feet vertically below No. 19, was opened in the Bunker Hill mine. The ore heretofore mined on No. 19 level was found on this No. 20 new level in improved quantity and grade; its full extent is not yet known; development of it continues actively. The Flood-Pike-Stanley ore shoot, first disclosed on Sullivan mine No. 6 level, and referred to in my last report, has been extensively mined and further developed throughout the year with gratifying results. This ore shoot was exposed on the Pike level of the Sullivan mine, again by crosscuts from the No. 9 (Kellogg mill tunnel) level, and recently its presence is further determined by the disclosure of handsome new ore on Bunker Hill No. 10 level 700 feet below its point of original discovery. Development work on No. 11 level, 200 feet still deeper, is believed to be close to this ore. The new ore body extends from the Sullivan across into the Bunker Hill mine and occupies an area which heretofore has been unproductive, thus removing the distinction between the Sullivan mine and Bunker Hill mine ore bodies, whose tonnages are therefore reported in one figure.

We have 2,481,858 tons of ore blocked out to date.

The Crescent mine and mill on the west side of Big Creek, controlled by the Bunker Hill & Sullivan Mining & Concentrating Co., operated continuously during 1930. The company mined 13,855 tons of copper-lead ore, which were reduced to 815 tons of concentrates in the 120-ton flotation plant. The concentrates, which contained 307,830 ounces of silver, 111,024 pounds of copper, and 34,014 pounds of lead, were shipped to the smelter at Bradley. The output was considerably less than that in 1929, and the mine ranked fifth as a producer of silver and eighth in copper in Idaho in 1930. According to figures given the county assessor, the ore was valued at $120,841. Cost of extraction was $76,214, freight and treatment $23,359, and betterment and repairs $33,669; the net loss was $12,401. The 5,000-foot Hooper tunnel was completed early in 1930, and a 500-foot vertical raise was completed to the upper workings. Ore is now handled through the lower tunnel to eliminate the use of the tramway.

The Caledonia property was operated by lessees who shipped 534 tons of silver-lead ore from old stope fillings. According to a statement of operations for 1930 published by the company, the ore contained 4,437 ounces of silver and 97,412 pounds of lead, which sold for $7,522. Smelter charges amounted to $4,914, and the company received a royalty of $391; after interest on bonds was credited and general expenses were paid the loss was $531.

The Constitution Mining & Milling Co. operated its mine and mill near the upper end of Pine Creek the first six months of the year, but production was suspended in July due to low metal prices. The output was nearly double that in 1929. The company treated nearly 24,000 tons of extremely complex lead-zinc ore in its 150-ton flotation plant and shipped more than 5,000 tons of combined lead-zinc concentrates to the electrolytic zinc plant at Anaconda, Mont. The mill is equipped with crushers, rolls, ball mills, classifiers, and a variety of flotation machines, but no attempt is made to separate the intimately associated lead and zinc minerals. The mine is operated through the No. 3 tunnel, which is about 2,360 feet long, and an 800-foot vertical shaft below the No. 3 tunnel. During the first half of 1930 the company did 50 feet of shaft sinking and 1,500 feet of drifting, and ore reserves were reported to have been greatly increased. The mine ranked sixth in output of zinc in Idaho in 1930 and was a large producer of lead and silver.

The Federal Mining & Smelting Co. operated the Page and Blackhawk mines, both producers of lead-zinc ore. New crushing equipment was installed at the 300-ton flotation plant at the Page mine, which was operated the entire year on ore from both properties. The company shipped about 14,300 tons of lead concentrates and zinc concentrates to plants in Montana and California. The Page mine is opened by an inclined shaft 1,275 feet deep and by 15,227 feet of tunnels, drifts, and crosscuts; 2,497 feet of development in drifting, raising, and crosscutting was done in 1930. From 74,744 tons of lead-zinc ore of milling grade, containing 9.44 per cent of lead, 2.46 per cent of zinc, and 4.39 ounces of silver to the ton, lead concentrates were produced that contained 288,592 ounces of silver and 12,595,608 pounds of lead, and zinc concentrates that contained 18.14 ounces of gold, 8,918 ounces of silver, 121,531 pounds of lead, and 1,636,982 pounds of zinc. The ore contains galena, sphalerite, and pyrite. The mine ranked fourth as a producer of lead in Idaho in 1930, sixth as a producer of silver, and tenth as a producer of zinc. According to the figures given to the county assessor, the concentrates had a gross value of $1,022,999. The cost of extraction was $440,732, freight and treatment $324,363, and betterment and repairs $34,264; the net profit was $223,640. The report of the Federal Mining & Smelting Co. for 1930 gives the following paragraphs.

> No shaft sinking was done during the year, and no additional ore was developed below the 1,200 level. Stope work above the 1,200 level on the Tony vein proved the ore to be of somewhat higher grade than on the upper levels.
>
> In the Blackhawk ground development work east of the shaft on the 1,200 level was done for a length of 835 feet but so far has not encountered commercial ore.
>
> Ore reserves at the end of the year are estimated at 431,500 tons of developed ore, a decrease of 106,700 tons below the estimated tonnage at the end of 1929. Total ore mined was 97,447 tons. The decrease in the ore reserves, amounting to 9,253 tons more than the ore mined, is accounted for by a revision in the estimated tonnage in parts of the Blackhawk ground.

The mining methods employed at the Page mine were described in a report [21] published in 1930.

The Blackhawk mine was worked through the Page property, and a total of 22,703 tons of lead-zinc ore was treated in the Page flotation plant. The lead concentrates contained 87,392 ounces of silver and 3,823,860 pounds of lead; and the zinc product contained 5.67 ounces of gold, 2,734 ounces of silver, 37,521 pounds of lead, and 502,434 pounds of zinc. The earnings in 1930 were $24,328. The property is opened by 13,409 feet of workings; and about 750 feet of development, chiefly in raises, was done in 1930. Additional notes on the property, taken from the annual report of the Federal Mining & Smelting Co., are given in the foregoing statement for the Page mine.

The Sidney Leasing Co. operated the Sidney mine on a production basis until July 1 and shipped more than 23,000 wet tons of lead-zinc ore by way of the 3½-mile aerial tramway to the Government Gulch spur of the Oregon-Washington Railroad & Navigation Co. The ore was treated at the Sweeny mill and separated by flotation into lead concentrates and zinc concentrates. The lead product was sold to the Bunker Hill smelter, and the zinc concentrates were shipped for treatment in the electrolytic zinc plant of the Sullivan Mining Co. The milling ore contained 52,459 ounces of silver, 2,900,804 pounds of lead, and 6,751,334 pounds of zinc. The mine ranked fourth as a producer of zinc in Idaho in 1930 and fourteenth as a producer of lead; it was also a large producer of silver. Development in 1930 consisted of sinking the inclined shaft to the eighth level. The mine is opened by several short tunnels, one of which is about 900 feet long, and an inclined underground shaft to the 800-foot level. According to the figures given to the county assessor, the company extracted 23,331 tons of ore, which had a gross value of $84,729. The cost of extraction was $88,453; the net loss was $3,724. A royalty was paid to the Sidney Mining Co., which reported a net profit of $10,104. No dividends were paid in 1930, either by the operating company or the company that owns the mine.

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[21] Berg, J. E., Mining Methods of the Page Mine of the Federal Mining & Smelting Co., Page, Idaho: Inf. Circ. 6372, Bureau of Mines, 1930, 9 pp.

Lessees continued operation of the Sierra Nevada mine in Government Gulch and shipped nearly 900 tons of first-class sulphide lead ore to the smelter at Bradley. A car of lead ore was also marketed from the Stewart property.

The Bunker Hill & Sullivan Mining & Concentrating Co. re-treated more than 114,000 tons of old tailings in the South mill, after the closing of the Star mine of the Sullivan Mining Co. The material was treated by flotation, and the resulting concentrates were said to contain more than 3,000,000 pounds of lead.

No ore was shipped by the Douglas Mining Co. in 1930, but the company reported that from January to May 517 feet of drifting was done on the vein from the bottom of the inclined shaft. In 1929 the output of the mine consisted of more than 300 tons of lead-zinc ore. The General Mines Corporation reported 850 feet of development at its property near the Page mine; this property was equipped with new surface machinery in 1929. The Little Sunshine Mining Co., operating the Palmer group on Big Creek, installed a new compressor and hoist, sank a 300-foot vertical winze at a point 4,200 feet from the portal of the tunnel, and did nearly 3,000 feet of drifting and crosscutting on two levels of the winze. The New Jersey Consolidated Mines Co. deepened its vertical shaft to the 300-foot level and did 675 feet of drifting on the new level; new pumps were installed to handle the large flow of water. The Pine Creek Lead-Zinc Mining Co. completed the erection of its new 200-ton flotation plant and repaired the No. 3 tunnel of the Little Pittsburg mine, but it treated no ore in 1930 due to the low price of metals. The Liberal King Mining Co. erected a new compressor plant and extended the main tunnel 600 feet.

Other nonproductive companies operating in the Yreka district that reported development in 1930 were the Keystone Mining Co., Carbonate Mining & Milling Co., Commercial Traveler Mining Co., Hilarity Lead-Silver Mining Co., Silver Dale & Big Hill Mining Co., Silver Crescent Mining Co., Highland-Surprise Consolidated Mining Co., North Bunker Hill Mining Co., and Wolverine Mining Co.

TWIN FALLS COUNTY

Placer bullion valued at $160 was recovered by sluicing operations at the Sandy Bar and another property on the Snake River near Twin Falls.

VALLEY COUNTY

The value of the production of metals in Valley County increased from $43,665 in 1929 to $316,484 in 1930 as a result of the increased output of silver-lead-zinc ore from the Lost Pilgrim & Hall-Interstate property, operated by the Bunker Hill & Sullivan Mining & Concentrating Co. The quantity of each metal, especially lead and zinc, increased decidedly.

Big Creek (Edwardsburg) district.—Placer bullion valued at about $730 was recovered from sluicing operations at the Pearl No. 2 and Baur properties on Big Creek.

Deadwood Basin district (Cascade).—The Bunker Hill & Sullivan Mining & Concentrating Co. operated the Lost Pilgrim & Hall-Interstate group continuously during 1930 and treated nearly 25,000 tons of lead-zinc ore in the 100-ton flotation plant completed in 1929. The ore contains galena, sphalerite, chalcopyrite, tetrahedrite, pyrite, siderite, and quartz and is reduced by selective flotation to lead concentrates and zinc concentrates. The products are hauled 54 miles by truck to loading bins at Cascade and are shipped by rail to the lead plant at Bradley and the zinc plant at Silver King. The mine is opened by a tunnel 3,400 feet long and various drifts and raises; no development was reported in 1930. Operations at the property were described in detail in the report of the mine inspector of Idaho for 1930.

Thunder Mountain district.—The Sunnyside Mining & Milling Co. continued operations at the Sunnyside group and treated 800 tons of siliceous gold ore in a 10-stamp amalgamation mill. Bullion valued at about $3,300 was sent to the assay office at Boise.

Yellow Pine district.—The Yellow Pine Co. continued active development of the Cinnabar and Meadow Creek groups in 1930. A new camp was erected at the portal of the Monday tunnel to serve both the Monday and Cinnabar tunnels, and a new hydroelectric power plant was completed and placed in operation in November. New hoisting equipment was installed in the Meadow Creek workings, and shaft sinking to connect with the Monday tunnel was started. The company reported 2,682 feet of work in the Monday and Cinnabar tunnels and 865 feet of drifts, crosscuts, raises, and shaft work in the Meadow Creek workings in 1930.

A little tunnel work was reported by the Profile-Tamarack Mines Co. at the Copper Cliffs & Spring Creek group. The Amalgamated Red Metals Mines Co. reported 350 feet of drifting done in 1930, but no ore was treated in the new 25-ton mill on the property.

WASHINGTON COUNTY

Heath district.—A car of oxidized lead ore was shipped from the Keystone property, and a little development was reported by the Baw Mining Co. and the Cuddy Mountain Mining Co.

Washington (Mineral Creek) district.—The Idaho Mineral Mining Co., operating the Addie Darris, Silver Still, and McCorkle groups, shipped a car of siliceous silver ore and a car of sulphide copper ore to smelters near Salt Lake City, Utah, and reported that 850 feet of development was done during 1930.

Weiser (Unorganized) district.—Two cars of gold ore from the Orohondo property were shipped to Garfield, Utah, for smelting, and several hundred tons of low-grade gold ore was treated in a small amalgamation mill.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON[1]

(MINE REPORT)

By C. N. GERRY and T. H. MILLER[2]

CONTENTS

	Page
Summary	661
Mining industry	665
Ore classification	666
Metallurgic industry	669
Review by counties and districts	671
Chelan County	671
Ferry County	672
Kittitas County	673
Okanogan County	673
Review by counties and districts—Continued.	
Pend Oreille County	673
Pierce County	674
Snohomish County	674
Stevens County	675
Whatcom County	677
Yakima County	677

SUMMARY

The value of the mine production of gold, silver, copper, lead, and zinc in Washington decreased from $552,233 in 1929 to $348,630 in 1930. The output of silver, copper, and zinc decreased decidedly, the largest decreases being in zinc from Pend Oreille County and copper from Snohomish County. There was, however, a fair increase in the output of lead from Stevens County, which offset the decrease in lead from Pend Oreille County, and a considerable increase in the output of gold from Whatcom County. The total value of the metal output of Washington in 1930 was less than that in any year since 1894 and less than half the yearly average for the decade 1921 to 1930, which was about $734,000.

Since 1860 Washington has yielded an output of the five metals as follows: Gold, $30,422,745; silver, 9,284,680 fine ounces; copper, 26,855,088 pounds; lead, 63,209,916 pounds; and zinc, 15,681,534 pounds. The total value has amounted to $47,463,890, of which 64 per cent represents the value of the gold. During the decade 1921 to 1930 gold represents 31 per cent of the total value of the metal output; silver, nearly 15 per cent; copper, 20 per cent; lead, 23 per cent; and zinc, nearly 11 per cent. No dividends were paid by any metal-mining company in the State in 1930.

The value of the metal output of Pend Oreille County decreased more than $117,000 because of the decreased output of lead-zinc ore from the Grandview mine near Metaline Falls, and the value of the metal output of Snohomish County decreased more than $87,000 as the drop in the price of copper resulted in the closing of the Sunset mine near Index. More lead ore was shipped from the mines near Northport, Stevens County; but the total value of the metal output of the county decreased from $53,885 in 1929 to $44,686 in 1930 on account of the marked drop in metal prices. The value of the metal output of Whatcom County increased from $55,349 in 1929 to $71,822 in 1930 as a result of the increased output of gold ore from the Boundary Red Mountain mine. More than 44 per cent of the total value of the State metal output in 1930 came from copper ore and concentrates shipped from the Sunset mine near Index, Snohomish County; but, as the average price of copper decreased from 17.6 cents a pound in 1929 to 13 cents a pound in 1930, the Sunset Copper Co. decreased its shipments of copper concentrates and closed the mill in August.

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[1] Work on manuscript completed October, 1931.

[2] The assistance of Paul Luff and LaRu Shepherd, of the Bureau of Mines, is acknowledged.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Washington, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore and old tailings (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	26	11	22,885	6,215.51	$128,486	142,450	$142,450
1922	33	13	36,046	9,044.43	186,965	205,046	205,046
1923	30	6	56,900	16,547.49	342,067	227,187	186,293
1924	30	4	44,383	14,977.72	309,617	213,742	143,207
1925	37	9	50,287	11,138.49	230,253	166,425	115,499
1926	49	9	54,343	9,340.82	193,092	171,649	107,109
1927	30	3	119,201	19,513.51	403,380	155,850	88,367
1928	37	1	64,554	16,310.45	337,167	99,738	58,347
1929	29	4	93,527	3,719.94	76,898	47,182	25,148
1930	24	14	45,456	4,244.81	87,748	32,816	12,634

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	251,544	$32,449	143,553	$6,460	449,360	$22,468	$332,313
1922	317,203	42,822	1,381,109	75,966	1,228,229	70,009	580,808
1923	871,999	128,184	2,906,479	203,454	3,024,535	205,668	1,065,666
1924	928,458	121,628	3,935,376	314,830	910,890	59,208	948,490
1925	1,159,057	164,586	5,627,241	489,570	1,217,846	92,556	1,092,464
1926	1,351,890	189,265	4,546,228	363,698	1,044,354	78,327	931,491
1927	1,685,848	220,846	955,003	60,165	1,279,710	81,901	854,659
1928	1,177,246	169,523	1,084,739	62,915	85,318	5,204	633,156
1929	1,400,489	246,486	1,015,190	63,956	2,117,344	139,745	552,233
1930	1,206,438	156,837	1,152,585	57,629	703,782	33,782	348,630

Gold and silver produced at placer mines in Washington, 1921–1930, in fine ounces

Year	Gold	Silver
1921	148.66	48
1922	162.44	49
1923	73.09	23
1924	33.77	12
1925	52.87	11
1926	1,354.50	456
1927	18.82	5
1928	90.85	30
1929	295.76	98
1930	190.90	43

GOLD

The production of gold in Washington increased from 3,719.94 ounces in 1929 to 4,244.81 ounces in 1930, but the output was far below the yearly average for the last decade. The increase was due chiefly to the activity at the Boundary Red Mountain mine in Whatcom County. The mines at Republic, Ferry County, large producers of gold in the past, remained virtually idle in 1930. Ore amalgamated yielded nearly 82 per cent of the total gold, ore shipped direct to smelters nearly 12 per cent, ore concentrated 2 per cent, and placers more than 4 per cent. More than 81 per cent of the total gold was recovered from gold ore from the Boundary Red Mountain mine in Whatcom County; most of the remainder came from gold ore from the Knob Hill mine in Ferry County, from placer operations near Molson in Okanogan County, and from copper ore from the Sunset mine in Snohomish County.

SILVER

The production of silver in Washington in 1930 was less than in any year since 1894. The output decreased from 47,182 ounces in 1929 to 32,816 ounces in 1930. A decrease of 8,337 ounces in output was recorded in Snohomish County and 3,144 ounces in Stevens County. Nearly 81 per cent of the total output of silver came from the United Copper mine near Chewelah, Stevens County, and the Sunset mine near Index, Snohomish County. Crude ore shipped to smelters yielded nearly 63 per cent of the total silver, and concentrates yielded nearly all the remainder. Copper ore yielded 84 per cent of the total silver, lead ore and lead-zinc ore nearly 11 per cent, and siliceous gold ore 5 per cent.

COPPER

The production of copper in Washington in 1930 decreased nearly 14 per cent in quantity from that in 1929 but was more than the annnual average for the decade 1921 to 1930, which was 1,035,017 pounds. Most of the copper (93 per cent) produced in 1930 resulted from milling operations at the Sunset mine near Index, Snohomish County; the total output from the mine decreased nearly 12 per cent as compared with that in 1929. A little crude copper ore was shipped from Index, Snohomish County, and Chewelah, Stevens County; and the new flotation plant of the Royal Development Co. near Leavenworth, Chelan County, treated several hundred tons of copper ore of milling grade.

LEAD

The production of lead in Washington increased more than 13 per cent in quantity in 1930 compared with 1929 as a result of increases in the output of lead from the property of the Pend Oreille

Mines & Metals Co. at Metaline Falls, Pend Oreille County, and from the Electric Point and Gladstone mines near Northport, Stevens County. The output of 1,152,585 pounds of lead in 1930, however, was much less than the annual average for the decade 1921 to 1930, which was 2,274,759 pounds. The Grandview mine at Metaline Falls, the largest producer of lead in Washington in 1929, was virtually idle in 1930. There would have been a decrease in the State lead output if it had not been for the work of the Pend Oreille Mines & Metals Co., which began milling lead-zinc ore in November and produced more than 35 per cent of the State's output of lead. The remainder came chiefly from the Electric Point and Gladstone mines near Northport, Stevens County. More than 45 per cent of the total lead production in 1930 came from first-class lead ore of smelting grade, and most of the remainder came from lead-zinc ore of milling grade.

ZINC

The production of zinc in Washington in 1930 was 703,782 pounds, which was less than one-third of the output in 1929. The marked decrease was due to the fact that the flotation mill of the Grandview Mines (Inc.) near Metaline Falls, Pend Oreille County, was idle nearly all the year. A larger decrease was prevented by the Pend Oreille Mines & Metals Co., at Metaline Falls, which began milling lead-zinc ore in November and produced most of the State's output of zinc.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1930, by counties, in terms of recovered metals

County	Gold (lode and placer)		Silver (lode and placer)	
	Fine ounces	Value	Fine ounces	Value
Chelan	2.42	$50	1,107	$426
Ferry	457.82	9,464	1,542	594
Kittitas	55.29	1,143	18	7
Okanogan	120.12	2,483	26	9
Pend Oreille	9.53	197	1,219	469
Snohomish	93.99	1,943	9,277	3,572
Stevens	35.02	724	19,454	7,490
Whatcom	3,470.62	71,744	173	67
	4,244.81	87,748	32,816	12,634
Total, 1929	3,719.94	76,898	47,182	25,148

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Chelan	12,825	$1,667					$2,143
Ferry	819	107	236	$12			10,177
Kittitas							1,150
Okanogan	32	4	34	2			2,498
Pend Oreille	625	81	549,354	27,467	703,782	$33,782	61,996
Snohomish	1,143,408	148,643					154,158
Stevens	48,645	6,324	602,961	30,148			44,686
Whatcom	84	11					71,822
	1,206,438	156,837	1,152,585	57,629	703,782	33,782	348,630
Total, 1929	1,400,489	246,486	1,015,190	63,956	2,117,344	139,745	552,233

Ore and old tailings sold or treated, lode mines producing, and average value of ore and old tailings in gold and silver in Washington, 1929 and 1930, by counties

County	Ore and old tailings (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Chelan	32	600	1	1	$5.94	$0.79
Ferry	382	559	4	5	32.68	17.53
Garfield	1		1		62.00	
Kittitas	12	34	1	2	27.00	11.18
Okanogan	2	9	1	1	1.00	37.22
Pend Oreille	50,920	7,232	2	3	.27	.06
Skamania	76		1		.28	
Snohomish	33,608	27,809	1	1	.39	.20
Stevens	3,796	2,107	15	9	3.39	3.62
Whatcom	4,694	7,106	1	2	11.79	10.11
Yakima	4		1			
	93,527	45,456	29	24	1.03	2.12

MINING INDUSTRY

In 1930 the mining industry of Washington and of other Western States was seriously affected by the general business depression and the unusual drop in the prices of silver, copper, lead, and zinc. The result in Idaho and Montana was a decided curtailment in the metal output of the large, regular producers; in Washington several of the important mines were closed most of the year. Gold was produced, as in the past, from Whatcom County; the output from Republic, however, has not been normal for several years, and no deep interest was shown in the search for new gold properties or the development of old producing mines. Washington has no active silver mines, and the output of silver from copper ore and siliceous ore was unimportant. The output of copper from the chief copper mine of the State was less than in former years, and the property was closed in August after having been productive for seven months. The production of both lead and zinc was small when compared with the normal annual output, and it was insignificant compared with that of Idaho and Montana. Development work in Washington, however, has opened lead-zinc ore in the Metaline district, Pend Oreille County, and copper ore at various properties in the western section of Chelan County. The Royal Development Co., near Leavenworth, continued its development program in the mine and built one section of a new flotation plant, but the serious decline in the price of copper caused a suspension of operations. The work at Metaline Falls, which gave promise of a large production of lead and zinc, was interrupted by financial difficulties following the general depression, and it was not until November that the old milling plant of the Pend Oreille Mines & Metals Co. was again active on lead-zinc ore.

ORE CLASSIFICATION

Ore and old tailings sold or treated in Washington, 1921-1930, with content in terms of recovered metals

DRY AND SILICEOUS ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	20,199	6,015.58	68,991	3,293	3,339	
1922	24,782	8,830.87	106,243	2,189	17,759	
1923	33,499	10,348.92	127,029	349	4,467	
1924	17,575	14,706.15	70,178	510		
1925	15,583	10,870.19	43,083	16		
1926	17,590	7,707.83	56,656	522		
1927	43,450	19,342.20	115,684	53	1,929	
1928	33,956	16,098.60	70,191	121	1,911	
1929	5,162	3,224.85	6,932	201	1,425	
1930	7,710	3,953.14	1,726	935	270	

COPPER ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1921	1,332	24.91	65,716	246,017		
1922	6,086	38.40	68,239	312,912	239	
1923	11,128	80.01	60,805	855,152		
1924	15,916	117.70	44,173	927,407		
1925	19,500	139.80	37,131	1,158,812		
1926	25,297	190.98	18,456	1,348,545		
1927	37,564	139.00	35,926	1,684,450		
1928	28,560	117.00	22,937	1,165,342		
1929	34,145	189.29	32,377	1,393,769		
1930	28,565	100.43	27,592	1,204,218		

LEAD ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1921	354	26.56	7,695	2,234	136,974	
1922	3,624	12.72	30,463	2,102	1,363,201	
1923	7,881	43.44	36,819	1,341	2,859,062	
1924	8,111	120.10	99,300	541	3,916,290	
1925	11,518	57.43	77,618	24	5,591,348	
1926	7,659	75.27	82,733	2,823	4,450,458	
1927	1,648	7.26	1,939	270	824,423	
1928	904	2.68	5,675	736	1,011,970	
1929	3,176	2.10	4,003	1,697	328,894	
1930	1,981	.34	2,435	970	617,945	

COPPER-LEAD ORE[1]

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1923	942	2.03	2,511	15,157	42,980	
1928	700	1.00	721	11,047	55,085	

ZINC ORE AND LEAD-ZINC ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1921	1,000				3,240	449,260
1922	1,554		52			1,228,229
1923	3,450					3,024,535
1924	2,781		79		19,116	910,890
1925	3,886	12.20	8,582	205	35,893	1,217,846
1926	3,788	12.24	13,448		95,770	1,044,354
1927	36,539	6.23	2,296	1,075	128,651	1,279,710
1928	434	.32	184		15,773	85,318
1929	51,044	8.03	3,772	4,762	684,871	2,117,344
1930	7,200		1,020	315	534,370	703,782

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[1] No production reported for 1921, 1922, 1924 to 1927, 1929, and 1930.

Ore and old tailings sold or treated in Washington in 1930, with content in terms of recovered metals

Source	Mines producing	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	12	[1] 7,710	3,953.14	1,726	935	270	----------
Copper ore	3	28,565	100.43	27,592	1,204,218	----------	----------
Lead ore	7	1,981	.34	2,435	970	617,945	----------
Lead-zinc ore	2	7,200	----------	1,020	315	534,370	703,782
Total, lode mines	24	45,456	4,053.91	32,773	1,206,438	1,152,585	703,782
Total, placers	14	----------	190.90	43	----------	----------	----------
	38	45,456	4,244.81	32,816	1,206,438	1,152,585	703,782
Total, 1929	33	93,527	3,719.94	47,182	1,400,489	1,015,190	2,117,344

[1] Includes 13 tons of old tailings sold to a smelter.

Value of metals from ore and old tailings sold or treated in Washington in 1930, by classes of ore

Class	Ore and old tailings (short tons)	Gold	Silver	Copper	Lead	Zinc	Total value
Dry gold ore	7,710	$81,719	$665	$121	$14	----------	$82,519
Copper ore	28,565	2,076	10,623	156,549	----------	----------	169,248
Lead ore	1,981	7	937	126	30,897	----------	31,967
Lead-zinc ore	7,200	----------	393	41	26,718	$33,782	60,934
	45,456	83,802	12,618	156,837	57,629	33,782	344,668
Total, 1929	93,527	70,784	25,096	246,486	63,956	139,745	546,067

DRY AND SILICEOUS ORE

Most of the dry and siliceous ore (92 per cent) in 1930 was gold ore from the Boundary Red Mountain mine in Whatcom County. The total output of gold ore and old tailings in 1930 was nearly 51 per cent more than that in 1929 but much less than that in 1928, when the mines at Republic were active. The total value of metals recovered from gold ore and old tailings was $82,519; the material averaged $10.60 in gold and 0.22 ounce of silver to the ton and a little copper and lead. No silver ore or gold and silver ore was treated or marketed in Washington in 1930.

COPPER ORE

Copper ore yielded metals valued at $169,248 in 1930, or nearly half the total value of the State's output; the ore averaged 7 cents in gold and 0.97 ounce of silver to the ton and 2.11 per cent of copper. Nearly all the copper ore came from Index, Snohomish County; it was largely milling ore. A test run, in a new flotation plant, was made on copper ore from the property of the Royal Development Co. near Leavenworth.

LEAD ORE

The metals recovered from lead ore in 1930 were valued at $31,967. More than 68 per cent of the ore came from the mine and waste dump of the Bonanza property near Bossburg, Stevens County; nearly all the remainder came from the Electric Point and Gladstone mines near Northport, also in Stevens County. The total lead ore yielded on the average 1.23 ounces of silver to the ton, 15.60 per cent of lead, and a little copper and gold.

LEAD-ZINC ORE

Lead-zinc ore yielded metals valued at $60,934 in 1930, a decrease of $124,973 from 1929. The ore yielded on the average 0.14 ounce of silver to the ton, 3.71 per cent of lead, and 4.89 per cent of zinc; nearly all of it came from the property of the Pend Oreille Mines & Metals Co. at Metaline Falls, Pend Oreille County. The Grandview mine, also at Metaline Falls, a producer of more than 50,000 tons of lead-zinc ore in 1929, was closed early in January, 1930, and was idle the remainder of the year; some of the zinc concentrates were still stored at the mill in July.

Ore and old tailings sold or treated in Washington in 1930, by counties, with content in terms of recovered metals

County	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
DRY GOLD ORE						
Ferry	[1] 559	445.49	1,540	819	236	
Kittitas	34	18.29	5			
Okanogan	9	16.10	6	32	34	
Stevens	2	2.62	2			
Whatcom	7,106	3,470.64	173	84		
	7,710	3,953.14	1,726	935	270	
Total, 1929	5,120	3,220.59	3,222	169		
COPPER ORE						
Chelan	600	2.43	1,107	12,825		
Snohomish	27,809	94.00	9,277	1,143,408		
Stevens	156	4.00	17,208	47,985		
	28,565	100.43	27,592	1,204,218		
Total, 1929	34,145	189.20	32,377	1,393,769		
LEAD ORE						
Pend Oreille	32		196	310	14,984	
Stevens	1,949	0.34	2,239	660	602,961	
	1,981	.34	2,435	970	617,945	
Total, 1929	3,176	2.10	4,003	1,697	328,894	
LEAD-ZINC ORE						
Pend Oreille	7,200		1,020	315	534,370	703,782
	7,200		1,020	315	534,370	703,782
Total, 1929	51,044	8.03	3,772	4,762	684,871	2,117,344

[1] Includes 13 tons of old tailings sold to a smelter.

Zinc products produced or marketed from Washington mines and mills in 1930

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of ore or concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Zinc concentrates	Pend Oreille	715	799, 752	55. 93	703, 782
		715	799, 752	55. 93	703, 782
Total, 1929		2, 394	2, 425, 955	50. 67	2, 117, 344

METALLURGIC INDUSTRY

More than 81 per cent of the total ore from Washington treated in 1930 was concentrated, chiefly copper ore from the Sunset mine in Snohomish County and lead-zinc ore from the property of the Pend Oreille Mines & Metals Co. in Pend Oreille County; nearly 16 per cent was gold ore amalgamated, virtually all from the Boundary Red Mountain mine in Whatcom County; and 3 per cent was crude ore shipped for smelting, chiefly lead ore from the Electric Point mine in Stevens County and gold ore from the Knob Hill mine in Ferry County.

Six milling plants in Washington were active in 1930. Four used flotation, one a combination of flotation and table concentration, and one amalgamation.

Ore and concentrates from mines in Washington were smelted mainly at Bradley, Idaho; Tacoma, Wash.; and Trail, British Columbia. Lead ore and concentrates were smelted at the Bunker Hill plant at Bradley, Idaho; copper material at Tacoma, Wash.; and siliceous ore at Trail, British Columbia. Zinc concentrates were either stored or shipped to an electrolytic plant. As in past years, smelting and refining were done by the Consolidated Mining & Smelting Co. of Canada (Ltd.) at an interesting group of plants at Trail, British Columbia. The lead refinery at Trail is the only electrolytic lead refinery in the West. An electrolytic bismuth plant was completed in 1929, and a zinc fuming plant was added in 1930.

The total ore concentrated in 1930 yielded 3,020 tons of concentrates; nearly 61 per cent was copper concentrate, and the remainder was zinc concentrate and lead concentrate. No concentration mills were operated full time in 1930, and a section of the new flotation plant in Chelan County was merely used experimentally. The ore concentrated in 1930, however, has been separated by classes, and an estimate has been made of the gross metal content of the mill feed. The gross metal content of the concentrates is also given, as well as the metals estimated to have been recovered.

Washington ore concentrated in 1930, by classes of ore, with gross metal content of mill feed

Class	Quantity (dry weight)	Gross content of mill feed by assay				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper ore	28, 336	116. 20	12, 465	1, 302, 820		
Lead ore	1, 350		1, 235	250	109, 500	
Lead-zinc ore	7, 200		1, 200	700	620, 000	999, 000
	36, 886	116. 20	14, 900	1, 303, 770	729, 500	999, 000
Total, 1929	87, 415	212. 92	25, 631	1, 391, 240	1, 027, 058	2, 685, 559

Washington ore concentrated in 1930, by methods of concentration

Method of concentration	Ore concentrated	Concentrates and metal content		
		Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	9, 150	1, 210	2. 43	3, 115
Gravity concentration and flotation [1]	27, 736	1, 810	90. 00	8, 868
	36, 886	3, 020	92. 43	11, 983
Total, 1929	87, 415	5, 013	180. 46	21, 679

Method of concentration	Concentrates and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	14, 123	13, 281	660, 107	627, 991	799, 752	703, 782
Gravity concentration and flotation [1]	1, 158, 258	1, 123, 510				
	1, 172, 381	1, 136, 791	660, 107	627, 991	799, 752	703, 782
Total, 1929	1, 283, 671	1, 237, 683	905, 356	852, 506	2, 383, 815	2, 083, 632

[1] No mills using gravity concentration only were active in 1930.

Gross metal content of Washington concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper	1, 837	92. 43	9, 975	1, 171, 758		
Lead	468		1, 808	543	619, 075	
Zinc	715		200	80	41, 032	799, 752
	3, 020	92. 43	11, 983	1, 172, 381	660, 107	799, 752
Total, 1929	5, 013	180. 46	21, 679	1, 283, 671	905, 356	2, 383, 815

Mine production of metals from Washington concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Ore to concentrating mills	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Chelan	600	27	2. 43	1, 107	12, 825		
Pend Oreille	7, 200	1, 065		1, 020	315	534, 370	703, 782
Snohomish	27, 736	1, 810	90. 00	8, 868	1, 123, 510		
Stevens	1, 350	118		988	141	93, 621	
	36, 886	3, 020	92. 43	11, 983	1, 136, 791	627, 991	703, 782
Total, 1929	87, 415	5, 013	180. 46	21, 679	1, 237, 683	852, 506	2, 083, 632
BY CLASSES OF CONCENTRATES							
Copper		1, 837	92. 43	9, 975	1, 136, 335		
Lead		468		1, 808	386	589, 431	
Zinc		715		200	70	38, 560	703, 782

Most of the crude ore shipped to smelters was lead ore from Stevens County and gold ore from Ferry County, both of which increased.

Gross metal content of Washington crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	594	482.59	1,516	976	284	----------
Copper	229	8.00	17,617	69,982	----------	----------
Lead	631	.34	1,447	1,184	546,452	----------
	1,454	490.93	20,580	72,142	546,736	----------
Total, 1929	1,417	566.85	25,262	168,459	178,055	42,140

Mine production of metals from Washington crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ferry	546	434.49	1,503	819	236	----------
Kittitas	30	13.00	3	----------	----------	----------
Okanogan	9	16.10	6	32	34	----------
Pend Oreille	32	----------	196	310	14,984	----------
Snohomish	73	4.00	409	19,898	----------	----------
Stevens	756	6.34	18,461	48,504	509,340	----------
Whatcom	8	17.00	2	84	----------	----------
	1,454	490.93	20,580	69,647	524,594	----------
Total, 1929	1,417	566.85	25,262	162,806	162,684	33,712

BY CLASSES OF ORE

Dry and siliceous	594	482.59	1,516	935	270	----------
Copper	229	8.00	17,617	67,883	----------	----------
Lead	631	.34	1,447	829	524,324	----------

REVIEW BY COUNTIES AND DISTRICTS

CHELAN COUNTY

Chelan Lake district.—The Chelan Copper Mining Co. operated the Holden group, which is opened by four tunnels aggregating 5,600 feet of work. In 1930 the company did 2,594 feet of crosscutting and drifting, 590 feet of raising, and more than 6,000 feet of diamond drilling. The property is one of the interesting copper prospects on the eastern slope of the Cascade Range, close to the claims of the Royal Development Co. in the Leavenworth district, where a large deposit of copper ore has been under development for several years.

Leavenworth district.—The Royal Development Co. operated property consisting of 114 claims on Red Mountain 40 miles north of Leavenworth. The Trinity tunnel, which is 2 miles long, is said to have opened 12,000,000 tons of low-grade copper ore, and there is a strong probability of developing a much greater quantity when connection is made between the St. Francis tunnel and the Trinity tunnel, 1,000 feet below. In August the company began the construction of a 200-ton unit of a new flotation plant equipped with jaw crusher, Symons cone crusher, ball mill, classifier, flotation machines, and American filter. The mill was operated experimentally in November, and the concentrates were stored. The program of development and mill building was interrupted by the marked drop in the price of copper; and all mining, development, and milling operations ceased early in December. Unfortunately, the general depresssion affected this project at a time when the company had completed a section of its mill and was starting to make a marketable product. The details of financing the company and the geology, development, reserves, and equipment of the deposit are fully described in the Mines Handbook.[3]

FERRY COUNTY

The value of the metal output of Ferry County was $10,177 in 1930, a decrease of $2,955 from that in 1929. The output of gold, the chief metal produced in the county, was small in 1930 as compared with that in 1927 and 1928, when the large gold producers at Republic were active.

Columbia River district.—A little placer gold was recovered from bars on the west side of Columbia River near Kettle Falls.

Curlew district.—The Lucile Dreyfus mine near Danville was worked by the Anderson-Sexsmith Mining Co., which shipped a car of gold ore for smelting. The shipment, however, was low-grade material, and the property was subsequently abandoned.

Enterprise (Covada) district.—A little gold was recovered from sluicing bench gravel of the Columbia River 4 miles south of Gifford.

Keller district.—No ore was marketed from the Keller district in 1930, but sinking was done at the Iron Creek property in the development of silver-lead ore. A little development was also done at the Inspiration and Pacific Mutual properties.

Republic district.—Three lode mines and one tailings dump in the Republic district produced 509 tons of ore and old tailings yielding $8,692 in gold, 1,446 ounces of silver, and 236 pounds of lead, valued in all at $9,261, or $18.19 in metals a ton. In 1929 two lode mines in the Republic district produced 351 tons of ore yielding $10,541 in gold and 3,035 ounces of silver, valued together at $12,159. The large gold producers in the district have been idle since 1928, as there has been no demand for siliceous gold ore at the plant of the Consolidated Mining & Smelting Co. of Canada (Ltd.), Trail, British Columbia. Shipments in 1930 consisted of siliceous gold ore, chiefly from the Knob Hill mine operated under lease. Gold ore was also shipped from the Old Republic and California mines, and some old tailings were marketed from the San Poil dump. The Blaine-Republic Mining Co. was organized to operate the Jim Blaine group, which adjoins the Old Republic mine. From 1896 to the end of 1930 the district produced 704,774 tons of ore and old tailings yielding $8,655,849 in gold, 2,575,104 ounces of silver, and 236 pounds of lead, valued in all at $10,274,427.

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[3] Rand, L. H., and Sturgis, E. B., The Mines Handbook: Suffern, N. Y., vol. 18, 1931, pp. 1935-2007.

KITTITAS COUNTY

Cle Elum district.—One car of siliceous gold ore from the Maud O property on Camp Creek near Ronald was shipped to the smelter at Tacoma. The gold occurs in iron sulphide but was too low in grade to pay the mining, transportation, and smelting charges.

Swauk district.—One lode mine and three placers in the Swauk district produced 4 tons of ore, $873 in gold, and 15 ounces of silver, valued together at $879. A small lot of bullion, produced from gold ore from former operations at the Bear Cat property on Baker Creek, was sold to the Seattle assay office. The electrically driven dredge of the Kittitas Gold Mining Co., which has a capacity of about 3,000 cubic yards a day, was idle, but a little placer bullion was recovered at the Sunrise and various claims at Liberty. The Livingston Placer Mines (Inc.) installed machinery and did hydraulicking on Swauk Creek late in 1929; but the work was not successful, and the company was dissolved in 1930.

OKANOGAN COUNTY

Meyers Creek district.—Placer bullion valued at $2,015 was recovered from the Walker group of claims near Molson, which were active from August to November.

Similkameen district.—Operations at the Slate Rock placer near Oroville and at other claims on the Similkameen River resulted in the marketing of bullion valued at $142.

Squaw Creek district.—The Sunshine mine, formerly the Hidden Treasure property, 3 miles southwest of Methow, produced one lot of first-class gold ore for smelting. The Methow Mining & Smelting Co. operated the Roosevelt property and did about 100 feet of tunnel work, which was said to have opened ore containing gold, silver, copper, and bismuth.

PEND OREILLE COUNTY

The value of the metal output of Pend Oreille County decreased from $179,592 in 1929 to $61,996 in 1930, chiefly because the Grandview mill at Metaline Falls was idle after January. The Pend Oreille Mines & Metals Co. prevented a larger decrease by operating its mill on lead-zinc ore for more than a month in November and December.

Metaline district (Metaline Falls).—Two placers and two lode mines in the Metaline district produced 7,200 tons of ore, $197 in gold, 1,023 ounces of silver, 315 pounds of copper, 534,370 pounds of lead, and 703,782 pounds of zinc, valued in all at $61,132; the ore had an average value of $8.46 in metals a ton. The marked decrease in the value of the output from $179,592 in 1929 was due to the fact that the Grandview property was idle most of the year and that the Pend Oreille Mines & Metals Co. was occupied with development until November and the old mill was not operated until that time. In 1929 practically all the ore milled in the district came from the Grandview mine near Metaline Falls, which is equipped with a modern 200-ton flotation plant. Although the property is credited with large reserves of lead-zinc ore the management decided to close the mine early in January, 1930, as the prices of lead and zinc were not considered sufficient for profitable operations. The Pend Oreille Mines & Metals Co. constructed and nearly completed a modern hotel at Metaline Falls, drove a 160-foot tunnel, and did 3,562 feet of diamond drilling on the company's claims, including the Josephine, Hortense, Oriole, Sullivan, and Yellow Head groups. The program of building a large new mill and an electrolytic zinc plant was interrupted by the marked drop in metal prices, so in November the old 200-ton concentration plant was reconditioned and operated for more than a month in 1930. The mill is close to the large stopes on the surface of the Sullivan property, where considerable lead-zinc ore was mined and milled in 1927. The company milled about 6,000 tons of lead-zinc ore in December and shipped several cars of exceptionally high-grade lead concentrates to the Bunker Hill smelter at Bradley, Idaho; but the zinc concentrates were held and shipped in 1931 to the electrolytic plant of the Evans-Wallower Zinc Co. at East St. Louis, Ill. A power plant on Flume Creek was completed during the year, considerable work which opened first-class lead ore was done on the Hidden Falls tunnel, and diamond drilling and trenching indicated additional reserves of lead-zinc ore near the surface workings of the Josephine property. The work of completing the new office buildings and hotel at Metaline Falls was suspended in April. The Bella May and Blue Bucket claims, from which ore was marketed from 1923 to 1927, were under lease to the Metaline Mining & Leasing Co. In 1930 the company did 300 feet of drifting and tunnel work and 200 feet of upraising which was said to have opened considerable lead-zinc ore especially rich in lead. It was reported that the company planned to market some of its high-grade lead ore, but metal prices late in the year did not warrant any shipments. A little placer gold was recovered from the banks of the Pend Oreille River in the vicinity of Metaline Falls.

Newport district.—The Comstock & Conquest property, formerly the Bead Lake group, was operated by the Hoover Mining Co., and one car of sulphide lead ore was shipped to Idaho for smelting. The company did 380 feet of development in opencuts and tunnels, but the 100-ton flotation plant at the property was idle.

PIERCE COUNTY

The copper smelter and refinery of the American Smelting & Refining Co. at Tacoma was active in 1930, but only a small portion of the charge was made up of ore and concentrates from mines in Washington. In the past considerable siliceous gold ore from Republic and copper material from Chewelah were shipped to Tacoma for smelting. In recent years shipments from Chewelah have decreased to a marked degree, but they have been replaced by copper concentrates from the Sunset mine near Index.

SNOHOMISH COUNTY

Index district.—The Sunset Copper Co. operated its mine and mill near Index and shipped copper concentrates and a little first-class ore to Tacoma for smelting. In 1930 it was the largest producer of copper in the State, a record which it has held since 1923. The mill, however, was not operated during the last quarter of the year, as the average price of copper was less than that in any year since 1921. Both the mine and the mill were closed in August; and the production of gold, silver, and copper was less than it has been since 1924. From January to August the company treated 27,736 tons of copper ore by gravity and flotation concentration and reported 1,650 feet of development, chiefly in drifting. In June it was stated that the company planned to develop the mine at greater depth by driving a lower tunnel, but the plans were probably interrupted by the sudden change in market conditions during the summer. The Skykomish Copper Co., operating claims near the Sunset Copper mine, reported the opening of fairly rich copper ore by surface trenching.

Stilaguamish district.—The Yankee Boy mine, a gold property near Granite Falls on the Hartford Eastern Railway, was operated by the newly organized Stillaguamish Mining Co.; and the Virginia-Agenda Co. was said to have opened a large quantity of ore containing gold, silver, and arsenic. Virtually no development was done in 1930.

STEVENS COUNTY

The value of the production of metals in Stevens County was $44,686 in 1930, or $9,199 less than that in 1929. The marked decrease in the total value of the output was due chiefly to the drop in metal prices, as there was an increase in the output of lead from the Electric Point and Gladstone mines near Northport.

Bossburg district.—The Bonanza mine at Bossburg was operated by the Northern Lead Mining & Milling Co., which treated more than 1,300 tons of lead ore in a 50-ton flotation plant. Several cars of lead concentrates were shipped to the Bunker Hill smelter at Bradley, Idaho. The property is opened by an inclined shaft 750 feet deep; in 1930 the fourth, fifth, and sixth levels were reconditioned, and 75 feet of drifting was done to open the ore body on the fifth level. The Young America Mining Co. cleaned out two of the old tunnels in the Young America mine and did about 50 feet of work in opening new ore. The property produces both lead and zinc ore, and some of the high-grade lead ore averages 100 ounces of silver to the ton.

Chewelah district.—The United Copper property northeast of Chewelah, owned by the Chewelah Union Mining Co., was not operated on company account. Shipments since 1925 have been made by lessees who had a lease on a portion of the mine from the 400-foot level to the surface and operated from an old shaft to the south. Six shipments made during 1930 contained approximately 16 per cent of copper and an average of more than 100 ounces of silver to the ton. In 1923 the property was a large producer of both silver and copper from a deposit containing tetrahedrite and chalcopyrite developed to a depth of 1,000 feet. The mine plant and mill building at the portal of the old tunnel have been abandoned. From 1912 to 1923 the mine and mill were actively operated on company account. At the Enterprise property near the United Copper mine 200 feet of tunneling was done in the development of silver-lead-copper ore. Some rich ore containing copper and silver was opened by the Northwest Mines Corporation, which worked the Copper Queen and Copper King properties adjoining the United Copper mine.

Columbia River district.—Placer dust valued at $217 was recovered from the banks of the Columbia River near Daisy and Gerome.

Colville and Clugsten Creek district.—No work was done at the Old Dominion mine, a fairly large producer of high-grade silver-lead ore from 1922 to 1927, but 160 feet of development was done at the Easy Money mine of the Magma Mines & Metals Co. Development was also done at the Chloride Queen and Silver Chief properties, but no ore was either treated or marketed.

Kettle Falls district.—Placer dust valued at $365 was recovered by lessees from bars and crevices along the Columbia River about 4 miles south of Kettle Falls. More than 400 feet of tunnel work was done at the Silver Queen property of the Ark Mines Co.; the main tunnel is now 1,600 feet long. Work was resumed at the Sunday Star mine, which is opened by tunnels and crosscuts on four levels.

Northport district.—In 1930 four lode mines in the Northport district produced 589 tons of ore yielding $4 in gold, 352 ounces of silver, 424 pounds of copper, and 507,855 pounds of lead, valued in all at $25,588, or $43.44 in metals a ton. The entire output was first-class lead ore of smelting grade, chiefly from the Electric Point and Gladstone mines. In 1929 five lode mines produced 204 tons of ore yielding metals valued at $11,891. The Electric Point mine on Gladstone Mountain was operated by lessees who shipped nearly 400 tons of oxidized and sulphide lead ore. The material contains an average of about 41 per cent of lead and less than 1 ounce of silver to the ton. No development was done other than the necessary drifting and stoping in the extraction of the ore. The property has been a producer of lead ore from chimneys in limestone since 1922, and the output was important in 1925 and 1926. The Gladstone Mountain property, which produced more than 2,000,000 pounds of lead in each of the four years from 1923 to 1926, was practically idle in 1930 except for work by lessees who shipped five cars of oxidized lead ore to Bradley, Idaho, for smelting. The Black Rock mine, an important producer of zinc in the last decade and particularly from 1922 to 1925, was idle in 1930; no shipments worthy of note have been made since 1927. The Van Stone property, which is being developed by a 600-foot tunnel, and the Lead Trust mine each produced small lots of lead ore of smelting grade.

Orient district.—The Acme Consolidated Mines (Inc.) did about 150 feet of drifting and sinking on the F. H. & C. property and shipped a sample lot of ore containing gold and silver. Other mining properties in the Orient district, including the Big Iron mine which formerly produced magnetic iron ore, were idle.

Springdale (*Cedar Canyon*) *district.*—The only output from the Springdale district consisted of a small lot of high-grade sulphide lead ore rich in silver shipped by the Venus Silver Mines Co. No vigorous development, however, was done at the property. In 1929, the Springdale district produced 295 tons of ore yielding metals valued at $9,639. The district includes the Turk mine, an old copper producer, and the Cleveland mine, a producer of lead and zinc, but both properties were idle in 1930, as it was not profitable to ship the ore 40 miles to the nearest railroad station under prevailing metal prices. A little development was done at the Aichan Bee mine, which was leased in June by the Mineral Hill Mining Co., and 750 feet of tunneling and drifting was done at the Monitor mine of the Deertrail Monitor Mines Co. In driving a tunnel at the Monitor mine to develop silver-lead ore a vein of molybdenite was encountered which was said to contain from 1 to 2 per cent of molybdenum.

Summit district.—The Consolidated Silver Mountain Mines Co., operating the Daisy mine, has blocked out considerable complex ore containing silver, lead, zinc, and arsenic. No lead or zinc products were marketed in 1930, but the company reported the sale of some arsenic ore for experimental purposes.

Valley district.—In 1930 the tunnel at the Admiral mine near Valley was advanced 800 feet.

WHATCOM COUNTY

Mount Baker district (*Sumas*).—The Westall Leasing Co. operated the Boundary Red Mountain mine south of Sardis, British Columbia, for 10 months and treated more than 7,000 tons of gold ore in the amalgamation mill. The bullion output was considerably more than in 1929 and only slightly less than in 1928. The mine has been a regular producer, except in 1926, for the past 10 years; in 1922 it produced gold valued at more than $90,000. In 1930, the production was valued at more than $70,000, considerably greater than the output of any other gold mine in Washington, particularly as the large gold producers at Republic were idle. A little development was done at the Verona property; and the Brooks-Willis property, an old producer, was kept in repair for possible resumption of operations.

Slate Creek district.—The Azurite Gold Mining Co. shipped a test lot of 8 tons of rich gold ore from its mine near Twisp and did 1,000 feet of development and 26 miles of road building.

YAKIMA COUNTY

Bumping Lake district.—The Northwest Tungsten Co. operated property near Goose Prairie and did a little work in opening ore containing gold and copper as well as scheelite.

GOLD, SILVER, AND LEAD IN SOUTH DAKOTA[1] [2]

(MINE REPORT)

By CHAS. W. HENDERSON

CONTENTS

	Page
Summary	679
Mining and metallurgic industry	681
Review by counties	682
Custer County	682
Review by counties—Continued.	
Lawrence County	682
Homestake mine	683
Pennington County	685

SUMMARY

Metal mining in South Dakota began with the discovery of placer gold in 1875 in the gravels of French Creek near the present site of Custer. To date it has been confined to the three southwestern counties—Custer, Lawrence, and Pennington—in what is known as the Black Hills. The Homestake gold mine at Lead, Lawrence County, has been producing almost continuously since 1876 and is now the largest producing gold mine in the United States. Ore from this mine to the company's mills amounted to 1,364,456 tons in 1930, a decrease of 73,479 tons from 1929, but the revenue from the sale of gold-silver bullion bars amounted to $8,426,195 in 1930—$1,908,357 more than in 1929. The realization per ton was $4.5328 in 1929 and $6.1755 in 1930. The only other producing lode mine in South Dakota in 1930 was the Columbia-Bullion group at Keystone, Pennington County, which was operated eight days. Banks and other bullion buyers in South Dakota marketed in 1930 placer bullion, accumulated in 1929 and 1930, containing 47.41 ounces of gold and 5 ounces of silver. The total recorded production of gold and silver (in terms of recovered metals) in South Dakota from 1875 to 1930, inclusive, has been $289,223,731 in gold and 7,770,064 fine ounces of silver.

The following table shows the number of producing mines, tons of ore produced, and recovered content of metals in South Dakota from 1921 to 1930.

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[1] Work on manuscript completed March, 1932.

[2] For information on the geology of the metal resources of South Dakota see Paige, Sidney, U. S. Geol. Survey Geol. Atlas, Central Black Hills Folio 219, 1925. Also, Connolly, J. P., and O'Harra, C. C., The Mineral Wealth of the Black Hills: South Dakota School of Mines Depts. of Geology and Mineralogy, Bull. 16, Rapid City, May, 1929.

Mine production of gold, silver, and lead in South Dakota, 1921–1930, in terms of recovered metals [1]

Year	Mines producing			Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Lead		Total value
	Lode	Placer	Total		Fine ounces	Value	Fine ounces	Value	Pounds	Value	
1921	3	6	9	1,725,685	319,524.95	$6,605,167	112,464	$112,464	4,000	$180	$6,717,811
1922	3	3	6	1,751,454	315,297.99	6,517,788	118,760	118,760			6,636,548
1923	5		5	1,665,439	309,905.05	6,406,306	95,844	78,592			6,484,898
1924	4		4	1,674,720	295,930.24	6,117,421	86,548	57,987			6,175,408
1925	3		3	1,590,079	289,747.10	5,989,604	96,133	66,716			6,056,320
1926	2	2	4	1,415,785	279,528.93	5,778,376	82,186	51,284			5,829,660
1927	2	2	4	1,376,583	322,031.74	6,656,987	96,171	54,529	138,000	8,694	6,720,210
1928	5	4	9	1,422,233	317,378.94	6,560,805	90,547	52,970	74,000	4,292	6,618,067
1929	2		2	1,463,159	316,836.85	6,549,599	85,182	45,402			6,595,001
1930	2	8	10	1,365,156	407,221.14	8,418,008	105,236	40,516			8,458,524

[1] For total production of gold and silver in South Dakota, by years, see Henderson, C. W., Mineral Resources, 1913, Pt. I, p. 42; Mineral Resources, 1922, Pt. I, p. 194, and subsequent volumes of same series.

Gold and silver produced at placer mines in South Dakota, 1921–1930 [1]

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1921	89.44	$1,849	7	$7	$1,856
1922	87.99	1,819	7	7	1,826
1926	6.43	133			133
1927	14.46	299			299
1928	11.13	230			230
1930	47.41	980	5	2	982

[1] No production in 1923–1925 and 1929.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

MINING AND METALLURGIC INDUSTRY

Production at the Homestake mine was continuous during 1930 despite the inconvenience caused by the fire at the Ellison hoist buildings on July 10. A review of the Homestake and other operations is noted under the review by counties.

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1921–1930

Year	Ore treated	Gold in bullion	Silver in bullion	Quicksilver used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1921	1, 620, 588	214, 003. 69	60, 604	22, 500
1922	1, 663, 525	218, 247. 50	58, 806	7, 500
1923	1, 652, 337	216, 907. 61	60, 624	10, 725
1924	1, 674, 720	203, 174. 24	52, 920	7, 625
1925	1, 589, 711	195, 865. 49	49, 812	7, 500
1926	1, 415, 785	187, 119. 66	47, 284	5, 625
1927	1, 371, 583	208, 952. 00	52, 480	14, 188
1928	1, 417, 029	211, 921. 22	51, 649	10, 550
1929	1, 437, 935	210, 869. 03	51, 676	9, 225
1930	1, 364, 456	270, 448. 01	65, 265	12, 021

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1921–1930

Year	Material treated			Gold in bullion	Silver in bullion	Sodium cyanide used [1]
	Crude ore	Sands and slimes	Total			
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*
1921	49, 047	1, 620, 588	1, 669, 635	105, 360. 12	50, 811	395, 228
1922	87, 929	1, 620, 699	1, 708, 628	96, 962. 50	59, 947	387, 683
1923	13, 087	1, 626, 234	1, 639, 321	92, 960. 74	35, 135	361, 900
1924		1, 647, 344	1, 647, 344	92, 756. 00	33, 628	361, 650
1925		1, 567, 555	1, 567, 555	92, 528. 61	32, 005	347, 242
1926		1, 402, 472	1, 402, 472	92, 402. 84	34, 902	299, 672
1927		1, 353, 298	1, 353, 298	113, 058. 32	41, 005	312, 626
1928	5, 109	1, 371, 096	1, 376, 205	105, 444. 56	37, 421	335, 675
1929	25, 224	1, 358, 870	1, 384, 094	105, 967. 82	33, 506	353, 859
1930	700	1, 348, 144	1, 348, 844	136, 725. 72	39, 966	[2] 382, 110

[1] In terms of 96 to 98 per cent strength.

[2] Actually 748,291 pounds of cyanamid (48 per cent) and 7,964 pounds of 96 to 98 per cent strength; cyanamid reduced to equivalent of 96 to 98 per cent strength to conform with earlier use of figures for high-strength NaCN and KCN.

Mine production of metals from South Dakota crude ore shipped to smelters, 1921–1930, in terms of recovered metals [1]

Year	Crude ore	Gold	Silver	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1921	157	71. 70	1, 042	4, 000
1923	15	36. 70	85	
1925	368	1, 353. 00	14, 316	
1928	95	2. 03	1, 477	74, 000

[1] No production in 1922, 1924, 1926, 1927, 1929, and 1930.

REVIEW BY COUNTIES

CUSTER COUNTY

Mine production of gold, silver, and lead in Custer County, S. Dak., 1921–1930, in terms of recovered metals [1]

Year	Mines producing		Ore	Gold (lode and placer)	Silver (lode and placer)	Lead	Total value
	Lode	Placer					
			Short tons		*Fine ounces*	*Pounds*	
1921	--------	3	----------	$582	1	--------	$583
1926	--------	1	----------	30	----------	--------	30
1927	1	--------	5,000	144	2,686	138,000	10,361
1928	1	--------	95	12	1,477	74,000	5,198
1930	--------	4	----------	131	----------	--------	131

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[1] No production in 1922–1925 and 1929.

Sundry small lots of placer gold, accumulated by banks from very small placer panning operations in the vicinity of Custer during 1929 and 1930, were marketed in 1930 in one lot of 7.30 ounces of bullion, which when melted at the Denver Mint weighed 6.90 ounces; the bullion was 0.920¾ fine in gold and 0.070½ fine in silver.

Development work was resumed October 1 at the Spokane property 17 miles northeast of Custer and 4½ miles southeast of Keystone. The last production from this property (in terms of recovered metals)—gold, silver, and lead—was in 1927 and 1928. Zinc concentrates were thrown away, and the zinc in lead concentrates was unrecovered at the Omaha lead smelter. The property is equipped with a 100-ton flotation mill. The minerals of the vein are pyrite, sphalerite, galena, and minute amounts of chalcopyrite. The property has been developed by a nearly vertical 325-foot shaft on the vein (82° dip), with levels at 60, 100, 200, and 300 feet.

The Western Star Mining Co. in 1930 installed a 60-horsepower Diesel power plant and a 385-cubic-foot compressor and built a store house, blacksmith shop, power house, and office on the property of the Western Star group of eight claims, in sec. 14, T. 3 S., R. 3 E., Black Hills meridian. This company enlarged the old shaft on the property to two compartments and sank the shaft to the 100-foot level.

LAWRENCE COUNTY

Mine production of gold, silver, and lead in Lawrence County, S. Dak., 1921–1930, in terms of recovered metals

Year	Mines producing			Ore	Gold (lode and placer)	Silver (lode and placer)	Lead	Total value
	Lode	Placer	Total					
				Short tons		*Fine ounces*	*Pounds*	
1921	3	--------	3	1,725,685	$6,603,318	112,457	4,000	$6,715,955
1922	2	2	4	1,751,414	6,515,969	118,753	------	6,634,722
1923	4	--------	4	1,665,437	6,406,206	95,844	------	6,484,798
1924	1	--------	1	1,670,300	6,091,100	86,354	------	6,148,957
1925	2	--------	2	1,590,069	5,988,570	96,133	------	6,055,286
1926	1	1	2	1,415,775	5,777,545	82,186	------	5,828,829
1927	1	1	2	1,371,583	6,656,738	93,485	------	6,709,744
1928	1	[1] 4	[1] 5	1,416,949	6,533,894	88,829	------	6,585,859
1929	1	--------	1	1,437,935	6,491,184	84,987	------	6,536,482
1930	1	4	5	1,364,456	8,410,937	105,184	------	8,451,433

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[1] Corrected figures.

HOMESTAKE MINE [3]

The total value of the product of the Homestake Mining Co. from 1876 to 1930, inclusive, is $234,547,323.40, and the amount paid in dividends is $57,868,684.29.[4]

Ore milled, receipts, and dividends, Homestake mine, 1921–1930

Year	Ore milled	Receipts for bullion product		Dividends
		Total	Per ton	
	Short tons			
1921	1, 620, 588	$6, 299, 780. 38	$3. 8873	$502, 320
1922	1, 663, 485	6, 285, 317. 56	3. 7784	879, 060
1923	1, 652, 337	6, 400, 078. 42	3. 8733	1, 506, 960
1924	1, 670, 300	6, 126, 349. 99	3. 6678	1, 758, 120
1925	1, 589, 701	5, 999, 073. 50	3. 7737	1, 758, 120
1926	1, 415, 775	5, 811, 943. 90	4. 1051	1, 758, 120
1927	1, 371, 583	6, 679, 802. 31	4. 8701	1, 758, 120
1928	1, 416, 949	6, 566, 784. 69	4. 6345	1, 758, 120
1929	1, 437, 935	6, 517, 837. 95	4. 5328	1, 758, 120
1930	1, 364, 456	8, 426, 195. 21	6. 1755	2, 009, 280

The annual report [5] of the general manager of the Homestake Mining Co. for the year ended December 31, 1930, says:

> Operations at the mine were temporarily interrupted by a fire which destroyed the Ellison hoist buildings, on the tenth day of July. The buildings were replaced before the end of the year, and ore is again being hoisted through this shaft.
>
> Production was not seriously curtailed; and, on the whole, the year 1930 was a satisfactory one from an operating standpoint.
>
> Following is a condensed report by the mine engineer:
>
> Development drifts driven 11,309 feet; development raises driven 8,536 feet.
>
> There are 675,650 tons of ore broken down and remaining in the stopes.
>
> There are 14,981,911 tons of ore blocked out and remaining in the mine.
>
> Development of the lower levels of the mine was carried on up to July with encouraging results. This work was curtailed during the last half of the year on account of the fire.
>
> Two Symons cone crushers have been installed at the Ellison hoist. Each unit has ample capacity to take the ore as fast as hoisted.
>
> A new high-pressure compressor is now being erected in the compressor room at the Ellison shaft.
>
> All of the shop buildings and B. & M. No. 2 shaft house have been equipped with automatic sprinklers. Cyanide No. 1 plant and Slime plant will be equipped with sprinkler systems early in 1931.

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[3] For description of geology see Paige, Sidney, The Geology of the Homestake Mine: Econ. Geol., vol. 18, 1923, pp. 205–237; Geology of the Region Around Lead, S. Dak., and Its Bearing on the Homestake Ore Body: U. S. Geol. Survey Bull. 765, 1924, 56 pp.; Central Black Hills, S. Dak.: U. S. Geol. Survey Geol. Atlas, Folio 219, 1925. Hosted, J. O., and Wright, L. B., Geology of the Homestake Ore Bodies and the Lead Area, South Dakota: Eng. and Min. Jour.-Press, vol. 115, May 5, 1923, pp. 793–799; May 12, 1923, pp. 836–843.

[4] For total production of the Homestake mine, 1876–1915, by the Homestake Mining Co. and its predecessors see Henderson, C. W., Mineral Resources, 1915, Pt. I, p. 346. The totals through 1930 are the sum of the 1876–1915 totals and the figures for subsequent years.

[5] See also Engineering and Mining Journal (extracts from report): Vol. 131, No. 6, Mar. 23, 1931, pp. 288 and 293. See also Clark, A. J., Milling Methods and Costs at the Homestake Mine, Lead, S. Dak.: Inf. Circ. 6408, Bureau of Mines, 1931, 25 pp.

Statement of operations of the Homestake mine, Lead, S. Dak., for the year ended December 31, 1930

Operating revenue:		
Bullion—		
Proceeds of bars 7464–7767	$8, 426, 195. 21	
During the year 1,364,456 tons of ore were milled, realizing an average of $6.1755 per ton.		
Golden Gate timber operation	28, 218. 82	
Wyodak coal operation	34, 558. 57	
Interest and rents	178, 542. 91	
		$8, 667, 515. 51
Operating expenses:		
Mining, hoisting, and primary crushing	3, 277, 336. 08	
Tramming	29, 761. 72	
Milling	763, 402. 86	
Express on bullion	9, 433. 69	
Employees' welfare	170, 616. 76	
Taxes	510, 887. 51	
Insurance	27, 091. 30	
Salaries, office, legal, and general expenses	201, 056. 59	
Loss Ellison hoist fire, less insurance	213, 911. 02	
Outside explorations; abandonments and investigation expenses	157, 194. 81	
		5, 360, 692. 34
Income		3, 306, 823. 17
Charges against income—reserved for depreciation and depletion		1, 813, 952. 56
Net income		1, 492, 870. 61
Dividends for the year:		
Paid from earnings		1, 506, 960. 00
Paid from depletion reserve		502, 320. 00
Total for year		2, 009, 280. 00

The Homestake mine is opened by three main shafts, the deepest of which is 2,600 feet, and by about 71 miles of adits, drifts, and crosscuts. In addition to the drifts and raises driven in 1930, a total of 11,789 feet of diamond drilling was done. The mining methods used at the Homestake were last described by Ross and Wayland in 1926.[6]

The milling plants operated by the Homestake Mining Co. in 1930 consisted of three amalgamation mills and three cyanidation mills. The amalgamation mills were the South mill at Lead, built in 1922; the Amicus mill at Lead, originally built in 1879; and the Pocahontas mill at Terraville, built in 1881. The cyanidation mills were the Sand plant No. 1 at Lead, built in 1901; the Sand plant No. 2 at Blacktail, built in 1902; and the Slime plant at Deadwood, built in 1906. The sands from the amalgamation mill at Terraville go to Sand plant No. 2, and the sands from the amalgamation mills at Lead go to Sand plant No. 1; the slimes from all three amalgamation mills go to the Slime plant.

The capacity and equipment of these mills are as follows: South mill—1,960 tons per day, 120 gravity stamps (1,550 pounds each), 2,860 square feet of amalgamating plates, eight 5 by 10 foot rod mills, three 5 by 14 foot tube mills, one 8 by 6 foot tube mill, 10 Dorr drag classifiers, and 13 cone classifiers; Amicus mill—1,309 tons per day,

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[6] Ross, A. J. M., and Wayland, R. G., Mining Methods at the Homestake: Min. and Met., vol. 7, No. 229, January, 1926, p. 21. See also Wiggert, J. F., Electrification of a Large Gold Mine: General Elec. Rev., vol. 32, No. 9, September, 1929, pp. 477–489.

240 gravity stamps (1,000 pounds each), 3,780 square feet of amalgamating plates, three 5 by 14 foot tube mills, two 5 by 18 foot tube mills, 5 Dorr drag classifiers, and 12 cone classifiers; Pocahontas mill—670 tons per day, 160 gravity stamps (900 pounds each), and 2,592 square feet of amalgamating plates; Sand plant No. 1—1,744 tons per day, 26 special cone classifiers, 18 special hydraulic classifiers, 19 leaching tanks (each 45 feet in diameter), 11 Dorr thickening tanks, 21 cone-bottom thickening tanks, and 2 Merrill precipitation presses; Sand plant No. 2—377 tons per day, 11 special cone classifiers, 6 special hydraulic classifiers, 4 leaching tanks (each 54 feet in diameter), 14 cone-bottom thickening tanks, and 1 Merrill precipitation press; and Slime plant—1,601 tons per day, 31 Merrill frame filter presses, and 2 Merrill precipitation presses. A summary of the foregoing shows that in 1930 the amalgamation plants had a total capacity of 3,939 tons per day and the cyanidation plants, of 3,722 tons per day.

The Bald Mountain Mining Co., which in 1928 bought the property of the Trojan Mining Co. (an important producer in the Bald Mountain area until 1923), continued in 1930 the incline adit begun in 1928 to cut the Two Johns ore body beyond a fault. In July, 1930, the adit reached ore at about 1,800 feet, and crosscuts were started to find the extent of the ore. Men were put to work repairing the "Trojan" cyanidation mill, and a surface tram was built from the mill to the Two Johns adit. The company reports that the ore suddenly changed from brown ore to blue refractory [7] ore and that no milling was done in 1930.

In June, 1930, geologists examined the long-idle Sitting Bull-Richmond group in the Bear Butte district; this work resulted in the driving of an adit on a lower contact to try to find ore assumed to be faulted downward from the upper workings. During 1930, a total of 600 feet of drifts was run.

Small placers on Potato, Beaver, and Iron Creeks near Tinton, Lawrence County, continued to yield small quantities (lots from 50 cents to less than $20 each) of placer gold which, with the 1929 yield, totaled 46.09 crude ounces and was marketed in 1930; when melted at the Denver Mint the weight was 44.39 ounces, and the fineness of the gold was 0.926 and that of the silver 0.056.

PENNINGTON COUNTY

Mine production of gold and silver in Pennington County, S. Dak., 1921–1930, in terms of recovered metals

Year	Mines producing		Ore	Gold (lode and placer)	Silver (lode and placer)	Total value
	Lode	Placer				
			Short tons		*Fine ounces*	
1921	----------	3	----------	$1,267	6	$1,273
1922	1	1	40	1,819	7	1,826
1923	1	----------	2	100	----------	100
1924	3	----------	4,420	26,321	194	26,451
1925	1	----------	10	1,034	----------	1,034
1926	1	----------	10	801	----------	801
1927	----------	1	----------	105	----------	105
1928	3	----------	5,189	26,869	241	27,010
1929	1	----------	25,224	58,415	195	58,519
1930	1	----------	700	6,940	52	6,960

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[7] For a proposed plan of treatment see Leaver, E. S., and Woolf, J. A., Cyanide Extraction of Gold and Silver Associated with Arsenic and Antimony in Ores: Tech. Paper 423, Bureau of Mines, 1928, 52 pp.

On January 8, 1930, part of the Keystone mill at Keystone was destroyed by fire, and the mill remained idle the rest of the year. This mill, originally built in 1896 as a stamp amalgamation mill, was remodeled in 1927 to a cyanidation mill by the Keystone Consolidated Mines Co. (Inc.), which undertook development of the old Columbia-Holy Terror-Keystone-Bullion-Lucky Boy group. The mill was operated part of 1928 and nearly all of 1929. The equipment consists of 1 gyratory and 1 jaw crusher, one 30-inch set of rolls, one 6 by 6 foot Allis Chalmers ball mill, 1 Dorr 4½ by 6 foot classifier, 3 Dorr 20 by 15 foot agitation tanks, and 5 Dorr 30 by 8 foot thickening tanks. After the fire at the mill some development work was continued for six months at the mine. The power plant was kept in operation to furnish light to the town of Keystone.

GOLD, SILVER, AND COPPER IN WYOMING[1]

(MINE REPORT)

By Chas. W. Henderson

CONTENTS

	Page
Summary	687
Review by counties and districts	688
Albany County	688
Carbon County	689
Converse County	689
Crook County	689
Review by counties and districts—Contd.	
Fremont County	689
Goshen County	690
Laramie County	690
Park County	690
Platte County	690

SUMMARY

In 1930 Wyoming metal mines (not including iron mines) produced gold, silver, and copper valued in terms of recovered metals at $10,713, compared with gold, silver, and copper valued at $1,766 in 1929. In 1930, in the Atlantic City district, Fremont County, one amalgamation mill and one amalgamation-concentration mill were operated for a short period, small lots of gold ore were shipped to smelters, several small lots of gold-silver bullion were cleaned from old mills, and a small quantity of placer gold-silver bullion was sluiced out of gravels; in the Copper Mountain district, Fremont County, a small quantity of gold ore was amalgamated, several small lots of gold ore were sent to smelters as tests, and one car of copper ore was shipped; in the Tie Siding district, Albany County, one car of mixed crude ore and concentrates (from experimenting in milling) was shipped to Garfield, Utah; and in Carbon County, a car of copper ore was shipped to Midvale, Utah, from the Elkhorn Mountain district, and small lots of gold-silver bullion were shipped to the Denver Mint from clean-up of old mills in the Seminoe and Encampment districts.

Mine production of gold, silver, and copper in Wyoming, 1921–1930, in terms of recovered metals[a]

Year	Ore (short tons)	Gold	Silver		Copper		Total value
			Fine ounces	Value	Pounds	Value	
1921	50	$62	111	$111	10,000	$1,290	$1,463
1922	24	1,207	57	57	4,296	580	1,844
1923	584	296	254	208	111,280	16,358	16,862
1927	110	1,200	5	3			1,203
1928	129	677	53	31	2,604	375	1,083
1929	143	995	26	14	4,301	757	1,766
1930	1,285	9,158	122	47	11,600	1,508	10,713

[a] No production in 1924–1926.

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[1] Work on manuscript completed March, 1932.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

REVIEW BY COUNTIES AND DISTRICTS

ALBANY COUNTY

Centennial district.[2]—The Cliff Gold Mining Co. reports that development work in 1930 consisted of sinking 60 feet of shaft, making the total development work on the property a 90-foot vertical shaft, an 800-foot adit, and 500 feet of drifts; the 50-ton amalgamation-concentration mill on the property was not operated. The Commercial Gold Mining Co., lessee of the Struggler and Marquette patented claims of the Utopia Mining & Milling Co., drove 450 feet of a lower working and drainage adit. Fifty feet of trenching was done at the Independence group. On 24 unpatented claims the Wyoming Platinum & Gold Mining Syndicate has in several years, including 1930, driven 1,100 feet in one adit and 153 feet in another and has sunk a 160-foot shaft; there is a mill building on the property and a 240-horsepower Diesel power plant.

Douglas Creek district (Holmes, Keystone).—Assessment work was done on claims surrounding the Rambler group at Holmes, once a producer of gold-silver-copper-platinum-palladium ore.[3] The last shipments from this mine were in 1923, when 55 tons of ore from the dump was settled for on a payment basis for contents of 8.56 ounces of gold, 104 ounces of silver, 6,717 pounds of copper, 4.39 ounces of platinum, and 23.99 ounces of palladium. Assessment work was done at the Gold Crater, Golden Crown, Independence, and Iron Blossom groups.

Tie Siding district.[4]—From the Atlas group and concentration mill (built originally in 1928) near Tie Siding, the Copper-Gold Mines Corporation shipped one car of mixed crude ore and concentrates carrying 6.45 per cent copper and no gold or silver.

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[2] For map and description of properties see Hess, F. L., Platinum Near Centennial, Wyo.; Contributions to Economic Geology: U. S. Geol. Survey Bull. 780, 1926, pp. 127–135.

[3] See Kemp, J. F., Platinum in the Rambler Mine, Wyoming: Mineral Resources, 1902, pp. 244–250.

[4] For general geology and cross section see Darton, N. H., and Siebenthal, C. E., Geology and Mineral Resources of the Laramie Basin, Wyoming: U. S. Geol. Survey Bull. 364, Plates I and VIII, 1909.

CARBON COUNTY

Encampment (*or Upper Platte*) *district.*—In the area surrounding the town of Encampment annual assessment work was done at several prospects. A car of copper ore carrying 5.75 per cent copper and 0.3 ounce of silver to the ton was shipped from the Bonanza King. The property is opened by 800 feet of adits and 100 feet of drifts; 200 feet of this development was done in 1930. A small lot of gold-silver bullion reclaimed from the old Penn-Wyoming mill was shipped to the Denver Mint.

Seminoe district.—A small lot of gold-silver bullion reclaimed from the idle mill at the Seminoe mine was sold to the Denver Mint.

CONVERSE COUNTY

No work was done in 1930 at the Miami group in sec. 10, T. 29 N., R. 75 W., of the sixth principal meridian, 25 miles from Douglas; the property is developed by a 280-foot shaft and 500 feet of drifts and is equipped with a steam plant for power, compressor, hoist, electric generator for lighting, station and sinking pumps, and air drills. At the Douglas & Denver lode in sec. 26, T. 32 N., R. 73 W., 12 miles west of Douglas, the 300-foot adit on the property was cleaned and reopened.

CROOK COUNTY

Assessment work was done at the Ada May placers on Sand Creek west of Tinton, S. Dak.

FREMONT COUNTY

Fremont County lode and placer mines in 1930 produced, in terms of recovered metals, $8,639 in gold, 91 ounces of silver, and 2,000 pounds of copper, with a total value of $8,934 for the three metals.

Atlantic City district.[5]—The Midwest Mines Corporation, lessee in 1928–1930 of the Carissa mine (once a producer but idle and kept unwatered for many years by its owners), operated for a short period the old Dexter stamp mill which it had moved in 1929 to the Carissa site; the mine is opened by a 384-foot shaft and 2,500 feet of drifts and crosscuts. The U. S. Mining & Milling Co. and its successor (the Union Gold Mining Co.) in 1930 milled, in the amalgamation-flotation-gravity concentration mill built on the McGrath or "1914"-Sullivan property in 1929, 1,000 tons of gold ore from which were recovered as bullion on the plates and in the concentrates 248.68 ounces of gold and 57 ounces of silver. Power is furnished to this property by a 265-horsepower Diesel engine. The mill is equipped with 1 Universal crusher, amalgamating plates, 1 Dorr classifier from which over 100-mesh product goes to a Marcy mill, 2 Card tables, and two 4-cell flotation machines. The district also produced small lots of gold-silver bullion sold to the Denver Mint from the Mary Ellen and Crismon-Duncan, a small lot of gold ore sent to the Omaha smelter from the Dandy group, and a small lot of accumulated placer gold-silver bullion sold to the Denver Mint. Gold and silver from the district averaged in fineness as follows: Mary Ellen, gold 0.746

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[5] For geology see Spencer, A. C., The Atlantic Gold District and the North Laramie Mountains, Fremont, Converse, and Albany Counties, Wyoming: U. S. Geol. Survey Bull. 626, 1916, 85 pp.

and silver 0.182; Crismon, gold 0.892 and silver 0.098½; Duncan, gold 0.736 and silver 0.172; Carissa, gold 0.600 and silver 0.149; McGrath-"1914"-Sullivan, gold 0.758 and silver 0.199; and placer accumulations, gold 0.740 and silver 0.156.

Copper Mountain district.—The Letellier Mining & Smelting Co. (Inc.) drove 220 feet of adit on the Tieup group in sec. 12, T. 40 N., R. 93 W., and shipped one car of copper ore to the Garfield smelter in Utah; this property is 17 miles northwest of Bonneville. The Western Mines (Inc.) operated for a short period the small amalgamating mill on the Gold Nugget property and shipped to the Denver Mint gold-silver bullion averaging in fineness 0.857¼ in gold and 0.119½ in silver.

GOSHEN COUNTY

Muskrat Creek district.—Assessment work only was done on copper prospects in the Muskrat Creek district.

LARAMIE COUNTY

Silver Crown district.—Assessment work was done at the Rambler-Silver Crown group and at the Monte Christo group.

PARK COUNTY

At the North Man group 28 miles south of Belfry, Mont., James Erickson drove 17 feet of adit, making a total development of 134 feet.

PLATTE COUNTY

Kumy Hills district (*Wheatland*).—Development work was continued at the Blue Jay group in sec. 20, T. 23 N., R. 69 W., from which a car of silver-copper ore was shipped in 1929.

Sunrise district.—The Colorado Fuel & Iron Co.'s Sunrise iron mine was idle part of the year but when in operation shipped iron ore to the company's iron and steel plant at Pueblo, Colo. No copper ore was shipped from this property in 1930.

COPPER [1]

By C. E Julihn and H. M. Meyer [2]

CONTENTS

Page
- General summary 691
  - World production 691
  - Burden of curtailment in production 695
  - World stocks 698
  - World consumption 699
  - Summary of domestic statistics 700
- Production in the United States 701
  - Three sources of production statistics 701
  - Smelter production 702
  - Mine production 704
  - Production by States and districts 705
  - Quantity and estimated recoverable content of copper-bearing ores 708
  - Review by States and companies 714
    - Scope of discussion 714
    - Alaska 715
      - Prince William Sound 715
      - Copper River district 715
    - Arizona 715
      - Bisbee district 716
      - Globe-Miami district 718
      - Morenci-Metcalf district 722
      - Yavapai County 723
      - Ray or Mineral Creek district 724
      - Ajo district 724
      - Pioneer district 725
    - California 725
    - Colorado 726
    - Idaho 726

Page

Production in the United States—Continued.

Review by States and companies—Contd.

- Michigan 726
  - Lake Superior district 726
- Missouri 730
- Montana 730
  - Butte district 730
- Nevada 732
  - Ely (Robinson) district 732
- New Mexico 734
  - Central (including Santa Rita) district 734
  - Lordsburg district 735
- Tennessee 735
- Utah 736
  - Bingham district 736
  - Tintic district 738
- Refinery production 738
  - Casting and pig copper 739
  - Lake copper 739
  - Electrolytic copper 739
  - Refined copper 739
- Secondary copper 740
- Copper sulphate 741
- Stocks 741
- Imports and exports 741
- Consumption 746
- Uses 746
- Prices 747

GENERAL SUMMARY

The world-wide depression of industry in 1930 was reflected in a severe decline in copper consumption and a nearly comparable curtailment of production. Output was not adequately reduced, however, to prevent a substantial increase in stocks. Maintenance of price, as stabilized in the previous year, became impossible; the price of copper broke from 17.775 cents a pound in April to less than 10 cents in October.

WORLD PRODUCTION

From official reports the Bureau of Mines estimated the world production of new copper as 1,573,000 metric tons, a decline of 332,000 tons (17 per cent) from the 1,905,000 tons produced in 1929. This decrease resulted from an output in the Western Hemisphere 346,937 tons (23.3 per cent) less than in 1929, although production in the rest of the world increased 15,000 tons (3.6 per cent).

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[1] Work on manuscript completed January, 1932.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from the records of the Bureau of Foreign and Domestic Commerce.

Production by continents and countries.—Production in North America declined 245,065 tons (21.7 per cent) and in South America 101,872 tons (28.5 per cent). Production in Africa increased 2,195 tons (1.5 per cent), in Europe 5,343 tons (3.0 per cent), in Asia 3,430 tons (4.2 per cent), and in Australia 4,090 tons (37 per cent).

Rank of continents in smelter production of copper, 1929 and 1930

Continent	Per cent of world total		Continent	Per cent of world total	
	1929	1930		1929	1930
North America	59.28	56.22	Africa	7.92	9.72
South America	18.75	16.23	Asia	4.26	5.38
Europe	9.21	11.49	Australia	.58	.96
				100.00	100.00

The second table following shows the world smelter production of copper by countries where smelted but not necessarily where refined. So far as possible, material from scrap has been eliminated. As the figures for the United States for 1926 do not include the smelter product from foreign ores, concentrates, and mattes, the content of the import of these materials has been included in the total for the world, in so far as can be done without duplication of figures elsewhere in the table.

World mine production of copper, 1926–1930, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [1]	1926	1927	1928	1929	1930
North America:					
Canada	60,371	63,569	91,941	112,545	137,655
Cuba [2]	9,028	13,433	6,431	4,604	11,798
Mexico	56,347	59,875	67,328	86,554	73,711
Newfoundland					1,000
United States	782,568	748,405	820,906	904,962	639,629
	908,314	885,282	986,606	1,108,665	863,793
South America:					
Argentina [3]	800	800			
Bolivia [4]	8,130	8,729	8,486	7,188	3,987
Chile	243,558	242,600	286,800	319,800	220,304
Peru	42,511	55,368	[5] 56,457	[5] 56,115	[6] 48,276
Venezuela	2,043	200			96
	297,042	307,697	351,743	383,103	272,663

[1] In addition to the countries listed, copper is produced in Asiatic Turkey, but data of output are not available.

[2] Copper content of ore, concentrates, and matte imported into the United States.

[3] Approximate production.

[4] Copper content of exports.

[5] Figures represent output of the more important districts only; that is, those reporting production of not less than 100 tons of fine copper.

[6] Content of sales and shipments.

World mine production of copper, 1926-1930, in metric tons—Continued

[Compiled by L. M. Jones, of the Bureau of Mines]

Country [1]	1926	1927	1928	1929	1930
Europe:					
Austria	2,238	2,332	3,035	2,081	2,216
Bulgaria [3]	1,700	1,300	1,000	2,000	2,000
Czechoslovakia	600	1,160	1,627	1,359	1,790
Finland	991	836	3,410	4,565	4,986
France	146	246	265	596	(7)
Germany	27,687	27,271	26,213	28,983	25,000
Great Britain	110	180	69	69	49
Greece	----------	----------	1	(8)	(7)
Hungary	22	(7)	----------	----------	----------
Italy	1,490	1,690	822	883	1,078
Norway	6,207	12,367	15,779	18,890	17,317
Portugal [3]	2,000	2,000	2,000	4,000	4,000
Rumania [9]	189	215	104	143	169
Russia [10]	11,500	[11] 14,400	[11] 20,200	[11] 26,000	[11] 37,000
Spain	49,500	49,600	54,200	63,700	59,000
Sweden	709	783	619	1,128	5,523
Yugoslavia	12,100	12,900	15,100	15,200	22,700
	117,189	[11] 127,280	[11] 144,444	[11] 169,597	[11] 182,828
Asia:					
China [12]	2,068	1,052	4,395	3,469	1,203
Cyprus [4]	3,056	4,275	4,900	5,900	5,200
India, British	5,900	5,100	5,500	7,200	8,200
Japan—					
Japan proper [9]	67,365	66,571	68,233	75,469	79,762
Chosen [9]	778	1,004	607	547	589
Taiwan	1,717	1,384	1,300	6,100	[3] 6,000
Russia	----------	(11)	(11)	(11)	(11)
	80,884	[11] 79,386	[11] 84,935	[11] 98,685	[11] 100,954
Africa:					
Algeria	489	273	230	25	1
Belgian Congo [9]	80,639	89,156	[13] 112,456	[13] 136,992	[13] 138,949
French Congo	384	500	383	186	(7)
Morocco, French	[4] 45	----------	----------	----------	----------
Rhodesia—					
Northern [9]	719	3,343	6,026	5,553	6,370
Southern [9]	7	----------	110	362	1,334
South-West Africa [14]	8,900	10,700	11,300	12,600	15,100
Tunisia	----------	12	----------	----------	----------
Union of South Africa	[9] 8,820	[9] 9,324	[9] 8,849	[9] 9,309	8,627
	100,003	113,308	139,354	165,027	170,381
Oceania:					
Australia	8,862	10,133	9,618	13,018	13,192
New Caledonia	----------	----------	----------	----------	(15)
Papua [16]	1,686	117	1	----------	(8)
	10,548	10,250	9,619	13,018	13,200
	1,514,000	1,523,000	1,717,000	1,938,000	1,604,000

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[1] In addition to the countries listed, copper is produced in Asiatic Turkey, but data of output are not available.

[3] Approximate production.

[4] Copper content of exports.

[7] Data not available.

[8] Less than half a ton.

[9] Smelter product.

[10] Year ended Sept. 30.

[11] Small output from Russia in Asia included under Russia in Europe.

[12] Exports of ingots and slabs.

[13] Includes copper smelted in Belgium from mattes and alloys produced in the Belgian Congo as follows: 1928, 946 tons; 1929, 1,453 tons; 1930, 2,545 tons.

[14] Year ended Mar. 31 of year following that stated.

[15] 1,000 tons of copper ore produced, content not stated.

[16] Copper content of exports for year ended June 30 of year stated.

World smelter production of copper, 1926–1930, in metric tons

[Compiled by L. M. Jones, of the Bureau of Mines]

Country[1]	1926	1927	1928	1929	1930
North America:					
Canada	30,199	31,947	56,619	72,661	101,554
Mexico	37,982	39,248	46,865	57,874	53,094
United States	[2] 789,075	[3] 843,850	[3] 911,444	[3] 998,789	[3] 729,611
	857,256	915,045	1,014,928	1,129,324	884,259
South America:					
Chile	188,875	226,160	274,900	303,188	207,991
Peru	[4] 42,940	46,377	52,292	53,962	47,287
	231,815	272,537	327,192	357,150	255,278
Europe:					
Austria	3,203	3,308	3,424	3,895	4,076
Belgium	10,006	9,810	[5] 9,720	[5] 8,940	[5] [6] 9,000
Czechoslovakia	718	743	1,010	1,694	1,521
Finland	365	354	375	235	[6] 200
France	1,627	1,896	1,142	1,392	[6] 2,000
Germany[7]	46,200	50,600	48,500	53,600	59,200
Great Britain[8]	17,900	22,600	21,400	23,700	20,200
Italy	420	450	900	539	262
Norway	192	13	788	2,400	5,149
Rumania[9]	189	215	104	143	169
Russia[10]	10,634	13,597	18,996	[6] 25,000	[6] 26,000
Spain	23,925	28,689	27,758	28,455	22,996
Sweden[11]	3,794	5,406	3,396	4,748	5,523
Yugoslavia	9,671	12,863	15,086	20,675	24,463
	128,844	150,544	152,599	175,416	180,759
Asia:					
China[12]	2,068	1,052	4,395	3,469	1,203
Chosen	778	1,004	607	547	589
India, British				1,661	3,022
Japan	67,365	66,571	68,233	75,469	79,762
	70,211	68,627	73,235	81,146	84,576
Africa:					
Belgian Congo	80,639	89,156	[13] 111,510	[13] 135,539	[13] 136,404
Rhodesia—					
Northern	719	3,343	6,026	5,553	6,370
Southern	7		110	362	1,334
Union of South Africa	8,820	9,324	8,849	9,309	[14] 8,850
	90,185	101,823	126,495	150,763	152,958
Oceania:					
Australia	11,327	9,718	12,048	11,049	15,139
Papua[15]	173				
	11,500	9,718	12,048	11,049	15,139
	[16] 1,459,000	1,518,000	1,706,000	1,905,000	1,573,000

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[1] In addition to the countries listed, copper is smelted in Asiatic Turkey, but data of output are not available.

[2] Smelter output from domestic material, exclusive of scrap. The production of refined copper from domestic and foreign material, exclusive of scrap, is reported as follows, in metric tons: 1926, 1,053,456 tons; 1927, 1,054,943 tons; 1928, 1,128,354 tons; 1929, 1,242,888 tons; 1930, 978,420 tons.

[3] Smelter output from domestic and foreign material, exclusive of scrap. The production from domestic material only, exclusive of scrap, was as follows: 1927, 763,864 tons; 1928, 828,210 tons; 1929, 908,479 tons; 1930, 632,481 tons. Figures for smelter output from foreign ores not available prior to 1927.

[4] Includes copper contained in ores, concentrates, and mattes exported.

[5] Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from the Belgian Congo and would, therefore, duplicate output reported under the latter country.

[6] Approximate production.

[7] Exclusive of material from scrap. (Metallgesellschaft, Stat. Zusammenstell.)

[8] Approximate production. (Imp. Inst., London.)

[9] Smelter output from domestic ores.

[10] Year ended Sept. 30.

[11] Exclusive of material from scrap.

[12] Exports of ingots and slabs.

[13] In addition to the crude copper smelted in the Belgian Congo, the following quantities were smelted in Belgium from matte and alloys produced in the Belgian Congo: 1928, 946 tons; 1929, 1,453 tons; 1930, 2,145 tons.

[14] Shipments.

[15] Copper content of blister exported in year ended June 30 of year stated.

[16] Includes copper content of ores, concentrates, and mattes imported into the United States, not elsewhere included.

The decline in North American production included decreases of 269,178 tons (27 per cent) in the output of the United States and of 4,780 tons (8.3 per cent) in that of Mexico. Canadian production, however, increased 28,893 tons (39.8 per cent).

In South America the curtailed output included a decrease of 95,197 tons (31.4 per cent) in Chile and a decrease of 6,675 tons (12.4 per cent) in Peru.

The small increase in Europe's output was compounded of relatively important changes in the yield of the five large producers and minor fluctuations in the output of all but one of the smaller. Of the large producers, Germany, Russia, and Yugoslavia reported increases of 5,600, 1,000, and 3,788 tons, respectively, while Great Britain reported a decrease of 3,500 tons and Spain of 5,459 tons; the resulting net increase for the five countries was 1,429 tons. The net increase for the nine smaller producers was 3,914 tons, a total net increase of 5,343 tons for Europe. Norway, the one small producer to make a significant change in output in 1930, again more than doubled its production as compared with that of the preceding year.

In Africa the larger production included small increases from the Belgian Congo and the Rhodesias, somewhat offset by a small decrease in the Union of South Africa.

The increase in Asia was due chiefly to Japan's larger output—4,293 tons more than in 1929; that in Australia to an increase from the Mount Lyell mine in Tasmania.

Rank of countries in smelter production of copper, 1928–1930

Rank in 1930	Country	Per cent of world total								
		1928			1929			1930		
1	United States	53.27	75.86	91.79	52.43	75.47	91.94	46.38	68.27	89.95
2	Chile	16.07			15.92			13.22		
3	Belgian Congo	6.52			7.12			8.67		
4	Canada	3.31	15.93		3.82	16.46		6.46	21.68	
5	Japan	3.99			3.96			5.07		
6	Germany	2.83			2.81			3.76		
7	Mexico	2.74			3.04			3.38		
8	Peru	3.06			2.83			3.01		
9	Russia	1.11	3.50		1.31	3.64		1.65	4.49	
10	Yugoslavia	[1].88			[1]1.09			1.56		
11	Great Britain	1.51			1.24			1.28		
	Other countries	4.71			4.43			5.56		
		100.00			100.00			100.00		

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[1] Spain produced 1.63 per cent of the total in 1928 and 1.49 per cent in 1929 but was displaced by Yugoslavia in 1930.

BURDEN OF CURTAILMENT IN PRODUCTION

The burden of curtailment in production has obviously been carried by countries of the Western Hemisphere, exclusive of Canada; interest therefore arises as to the extent to which various operating groups have been affected. The curtailment can not be accounted for completely here; but the following compilation, derived from company or other published reports, reveals the outstanding features of the curtailment situation.

The data reported by some of the companies shown in the following tables are based on mine production, whereas those reported by others are based on smelter or refinery production. The totals for the companies given are therefore neither mine nor smelter totals but a combination of the two. The value of the table is not lessened because of these differences, however, as the figures for one year are comparable with those for the other, and changes in rates of production during the two years for individual properties and for groups are brought out clearly.

Production of copper by American groups, 1929 and 1930

Controlled in Western Hemisphere	Production (pounds)		Increase or decrease	
	1929	1930	Pounds	Per cent
UNITED STATES				
Anaconda group:				
Montana	297, 014, 107	197, 233, 145	−99, 780, 962	−34
Andes Copper	162, 663, 775	94, 045, 494	−68, 618, 281	−42
Chile Copper	299, 575, 752	179, 191, 243	−120, 384, 509	−40
Greene Cananea	58, 826, 951	42, 424, 773	−16, 402, 178	−28
Walker (California)	15, 031, 978	15, 776, 171	+744, 193	+5
Inspiration	107, 307, 067	65, 606, 664	−41, 700, 403	−39
	940, 419, 630	594, 277, 490	−346, 142, 140	−37
Kennecott group:				
Alaska[1]	28, 182, 558	22, 990, 400	−5, 192, 158	−18
Mother Lode Coalition	12, 242, 740	9, 646, 800	−2, 595, 940	−21
Nevada Consolidated[2]	266, 274, 918	141, 980, 173	−124, 294, 745	−47
Utah Copper	296, 625, 554	161, 138, 717	−135, 486, 837	−46
Braden	176, 325, 895	161, 986, 598	−14, 339, 297	−8
	779, 651, 665	497, 742, 688	−281, 908, 977	−36
Phelps Dodge-Calumet and Arizona group:				
Copper Queen	127, 605, 697	84, 195, 921	−43, 409, 776	−34
Morenci	55, 073, 615	42, 618, 265	−12, 455, 350	−23
Moctezuma	42, 070, 000	28, 704, 000	−13, 366, 000	−32
Calumet and Arizona	130, 486, 607	88, 839, 719	−41, 646, 888	−32
	355, 235, 919	244, 357, 905	−110, 878, 014	−31
Miscellaneous Arizona group:				
Yavapai district[3]	208, 172, 000	117, 690, 000	−90, 482, 000	−43
Miami	58, 841, 159	67, 124, 596	+8, 283, 437	+14
Magma	38, 235, 310	31, 884, 271	−6, 351, 039	−17
Old Dominion	18, 943, 441	17, 596, 795	−1, 346, 646	−7
Shattuck Denn	12, 736, 150	9, 948, 220	−2, 787, 930	−22
Iron Cap	4, 417, 770	6, 924, 735	+2, 506, 965	+57
Arizona Commercial	3, 800, 456	3, 644, 877	−155, 579	−4
	345, 146, 286	254, 813, 494	−90, 332, 792	−26
Lake Superior group:				
Calumet & Hecla	123, 830, 000	105, 740, 000	−18, 090, 000	−15
Isle Royale	10, 864, 085	10, 659, 413	−204, 672	−2
Copper Range	24, 197, 316	23, 793, 918	−403, 398	−2
Mohawk	20, 043, 127	2, 706, 762	−17, 336, 365	−86
Quincy	4, 459, 426	10, 939, 787	+6, 480, 361	+145
	183, 393, 954	153, 839, 880	−29, 554, 074	−16
Sundry mines in the United States:				
Consolidated Copper mines (Nevada)	22, 731, 703	32, 612, 203	+9, 880, 500	+43
Bingham district[4] (Utah)	13, 051, 268	11, 882, 914	−1, 168, 354	−9
Ohio Copper (Utah)	2, 215, 178	2, 048, 369	−166, 809	−8
Tintic district (Utah)	3, 166, 000	2, 862, 000	−304, 000	−10
Engels (California)	11, 000, 162	4, 072, 628	−6, 927, 534	−63
	52, 164, 311	53, 478, 114	+1, 313, 803	+3

[1] Kennecott and Latouche mines.

[2] Includes Ely operations in Nevada, Ray in Arizona, and Chino in New Mexico.

[3] Production of individual mines not published.

[4] Other than Utah Copper and Ohio Copper.

Production of copper by American groups, 1929 and 1930—Continued

Controlled in Western Hemisphere	Production (pounds)		Increase or decrease	
	1929	1930	Pounds	Per cent
Cerro de Pasco (Peru) [5]	99,986,000	86,000,000	−13,986,000	−14
Total production controlled in United States accounted for	2,755,997,765	1,884,509,571	−871,488,194	−32
OTHER COUNTRIES				
Canada:[6]				
Granby [5]	60,854,000	46,832,000	−14,022,000	−23
Noranda [5]	51,626,000	76,142,000	+24,516,000	+47
Britannia [5]	43,032,000	45,266,000	+2,234,000	+5
Consolidated [5]	8,346,000	14,128,000	+5,782,000	+69
Other [7]	84,262,760	121,110,356	+36,847,596	+44
	248,120,760	303,478,356	+55,357,596	+22
Mexico (sundry):				
Boleo [5]	25,598,000	27,870,000	+2,272,000	+9
Mazapil [5]	12,478,000	8,756,000	−3,722,000	−30
Mexican Corporation [5]	3,382,000	3,438,000	+56,000	+2
	41,458,000	40,064,000	−1,394,000	−3
Grand total production accounted for	3,045,576,525	2,228,051,927	−817,524,598	−27
Total production of Western Hemisphere	3,277,113,283	2,512,248,340	−764,864,943	−23
Per cent of total Western Hemisphere production accounted for	93	89		

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[5] Year Book, American Bureau of Metal Statistics, 1930, pp. 14–15.
[6] Dominion Bureau of Statistics, Mineral Production of Canada, annual reports.
[7] Includes production of International Nickel Co.

Summary of production of copper by American groups, 1929 and 1930

Group	Production (short tons)		Increase or decrease	
	1929	1930	Short tons	Per cent
Anaconda	470,210	297,139	−173,071	−37
Kennecott	389,826	248,871	−140,955	−36
Phelps Dodge, etc	177,618	122,179	−55,439	−31
	1,037,654	668,189	−369,465	−36
Miscellaneous Arizona	172,573	127,407	−45,166	−26
Lake Superior	91,697	76,920	−14,777	−16
Sundry United States operations	26,082	26,739	+657	+3
Cerro de Pasco	49,993	43,000	−6,993	−14
	340,345	274,066	−66,279	−19
Total production controlled in United States accounted for	1,377,999	942,255	−435,744	−32
Canadian production (total)	124,060	151,739	+27,679	+22
Mexican production (sundry)	20,729	20,032	−697	−3
Grand total production accounted for	1,522,788	1,114,026	−408,762	−27
Total production of Western Hemisphere	1,638,557	1,256,124	−382,433	−23
Miscellaneous production not accounted for	115,769	142,098	+26,329	+23
Per cent of total Western Hemisphere production accounted for	93	89		

Obviously, the three largest groups operating in the Americas carried the chief burden of world curtailment in production but were substantially supported by other important American producers, except those in Canada, while minor operations tended to maintain production or to increase it. The Anaconda, Kennecott, and Phelps Dodge groups together curtailed production more than 369,000 short tons, equivalent to more than the net curtailment in world production (366,000 short tons). The average curtailment of these three groups was 36 per cent of their 1929 production; that of other production listed as controlled in the United States was 19 per cent, which applies to a tonnage about one-third as large as that of the three chief production groups.

The foregoing tables have accounted for 93 per cent of the production in the Western Hemisphere for 1929 and 89 per cent of its production for 1930. In the tonnage not accounted for except by difference there was an increase of 23 per cent, or more than 26,000 tons, which about equals the increase in Canadian production, a fact generally unnoticed, although the Canadian increase has induced much comment.

WORLD STOCKS

World stocks of copper increased 136,763 short tons during 1930—from 466,284 tons at the beginning to 603,047 tons at the end of the year.[3] This represents an increase of 29.3 per cent as stocks are usually reckoned. It is questionable, however, whether the change in stocks, reckoned on their whole nominal amount, is really as indicative of the true change as that reckoned on surplus above the quantity of copper permanently locked up in stocks. The minimum amounts of the various forms of world stocks reported by the American Bureau of Metal Statistics for 1925 to 1931, inclusive, have been as follows:

Minimum stocks of blister and refined copper recorded at beginning of any year, 1925–1931, and year in which minimum occurred

	Minimum stocks at beginning of any year, 1925–1931 (short tons)	Year at beginning of which minimum occurred
Blister:		
At North American smelters	5,596	1925
At North American refineries	24,543	1928
In transit from North American smelters to refineries	22,878	1931
At South American smelters	1,174	1931
In transit from South America to the United States	3,460	1931
Copper in process of refining, North and South America	130,616	1925
Refined copper, North and South America	65,466	1929
Stocks in Great Britain and Japan and at Havre	16,313	1929
Total of minimums	270,046	

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[3] American Bureau of Metal Statistics, Year Book, 1930, p. 13.

Obviously, a minimum of 270,000 tons of copper reported as stocks must always be tied up in process, in transit, and in copper awaiting treatment or shipment. In fact, a coincidence of minimums in all such items at the same time is so improbable that a rounded estimate of 300,000 tons of unavailable stocks is warranted. This assumption is supported by the fact that the lowest total of stocks actually reported for the beginning of any of the seven years was 331,774 tons at the beginning of 1929; and even in March, 1929, when the price of copper soared momentarily above 20 cents, stocks of 314,000 tons were reported. At that time, although nominal stocks exceeded 300,000 tons, no unsold copper was actually available. The increase of 29.3 per cent in nominal stocks during 1930 represented, therefore, an increase of about 80 per cent in stocks of copper actually available.

WORLD CONSUMPTION

Apparent world consumption, as computed from smelter production and world stocks, declined from 1,965,391 short tons in 1929 to 1,597,161 tons in 1930, a decrease of 368,230 tons (18.7 per cent). Deliveries of refined copper for consumption, as reported by the American Bureau of Metal Statistics, declined from 2,091,000 short tons in 1929 to 1,731,800 tons in 1930, a decrease of 359,200 tons (17.2 per cent). The excess of smelter production over consumption in 1930 was 136,773 short tons.

World consumption of copper, 1926–1930, by continents, in per cent

Continent	1926	1927	1928	1929	1930	Average of averages, 1926–1930
North America	53.1	47.4	49.2	54.6	47.8	50.4
Europe	39.6	46.1	44.8	40.5	46.5	43.5
Japan	5.2	4.7	4.4	3.8	4.5	4.5
	97.9	98.2	98.4	98.9	98.8	98.4

Price.—The price of 17.775 cents a pound at Atlantic seaboard refineries—stabilized by Copper Exporters (Inc.) in April, 1929—persisted until April, 1930, when a drop of 4 cents a pound on April 15 was soon followed by further declines to a minimum of 9.275 cents in October; the price on the last market day of the year was 10.275 cents.

SUMMARY OF DOMESTIC STATISTICS

Summary of statistics of the copper industry in the United States, 1921-1930

	1921	1922	1923	1924	1925
Production of copper:					
Smelter output from domestic ores pounds	505,586,098	950,285,947	1,434,999,902	1,634,249,192	1,674,869,886
Mine production do	466,190,856	964,583,894	1,477,739,709	1,600,165,018	1,678,117,747
Refinery production of new copper					
Electrolytic pounds	506,532,984	766,944,836	1,302,454,492	1,499,223,447	1,533,995,439
Lake do	100,918,001	122,545,126	137,691,306	145,333,227	138,029,764
Casting and pig do	1,963,271	15,180,723	24,019,197	29,657,925	10,870,144
Total domestic do	609,414,256	904,670,685	1,464,164,995	1,674,214,599	1,682,895,347
Total domestic and foreign do	950,777,815	1,255,015,959	1,979,835,016	2,260,076,010	2,204,573,834
Total new and old copper do	1,385,000,000	1,927,000,000	2,802,000,000	3,037,000,000	3,045,000,000
Ore produced:					
Copper ore short tons	13,396,382	26,893,247	45,519,317	49,178,315	53,103,014
Average yield of copper, per cent	1.70	1.74	1.58	1.59	1.54
Copper-lead and copper-lead-zinc ores short tons	14,248	52,370	162,181	219,874	228,612
Average price per pound cents	12.9	13.5	14.7	13.1	14.2
Imports (unmanufactured) pounds	350,472,611	541,013,220	676,473,338	768,813,731	652,971,407
Exports of metallic copper[1] do	628,415,714	742,755,957	828,854,827	1,116,775,136	1,082,369,439
Withdrawn from total supply on domestic account:					
Total new copper pounds	610,988,744	896,633,833	1,300,473,331	1,354,742,564	1,401,012,091
Total new and old copper do	1,046,000,000	1,568,000,000	2,122,000,000	2,131,000,000	2,241,000,000
Stocks at end of year:					
Refined copper do	459,000,000	216,000,000	264,000,000	243,000,000	124,000,000
Blister and materials in solution pounds	283,000,000	361,000,000	432,000,000	393,000,000	432,000,000
Value of smelter production from domestic ores	$65,221,000	$128,289,000	$210,945,000	$214,087,000	$237,832,000
World production (smelter) pounds	1,229,277,000	1,904,793,000	2,683,025,000	2,987,263,000	3,093,085,000

	1926	1927	1928	1929	1930
Production of copper:					
Smelter output from domestic ores pounds	1,739,622,094	1,684,040,983	1,825,900,393	2,002,863,135	1,394,389,327
Mine production do	1,725,275,931	1,649,959,370	1,809,796,907	1,995,110,398	1,410,147,374
Refinery production of new copper					
Electrolytic pounds	1,553,041,424	1,520,076,181	1,607,120,026	1,785,754,654	1,228,416,733
Lake do	172,372,304	195,135,199	179,104,311	185,300,917	142,985,522
Casting do	5,883,433	3,740,819	5,573,050	11,676,718	19,821,950
Total domestic do	1,731,297,161	1,718,952,199	1,791,797,387	1,982,732,289	1,391,224,205
Total domestic and foreign pounds	2,322,485,376	2,325,763,709	2,487,607,779	2,740,112,376	2,157,059,178
Total new and old copper do	3,282,000,000	3,306,000,000	3,560,000,000	3,993,000,000	3,091,000,000
Ore produced:					
Copper ore short tons	57,181,894	56,725,460	62,097,132	[2]68,421,853	[2]47,381,509
Average yield of copper, per cent	1.46	1.41	1.41	1.41	1.43
Copper-lead and copper-lead-zinc ores short tons	282,015	418,601	351,131	259,126	246,430
Average price per pound cents	14.0	13.1	14.4	17.6	13.0
Imports (unmanufactured) pounds	779,441,803	718,322,990	787,073,640	974,312,201	817,154,236
Exports of metallic copper[1] do	960,220,112	1,069,493,121	1,121,186,640	992,895,119	753,114,927
Withdrawn from total supply on domestic account:					
Total new copper pounds	1,570,136,207	1,422,959,219	1,608,538,878	1,778,585,415	1,265,016,702
Total new and old copper do	2,530,000,000	2,403,000,000	2,681,000,000	3,032,000,000	2,199,000,000
Stocks at end of year:					
Refined copper do	146,000,000	171,000,000	114,000,000	306,000,000	615,000,000
Blister and materials in solution pounds	455,000,000	401,000,000	423,000,000	500,000,000	450,000,000
Value of smelter production from domestic ores	$243,547,000	$220,609,000	$262,930,000	$352,504,000	$181,271,000
World production (smelter) pounds	3,216,543,000	3,346,616,000	3,761,085,000	4,199,805,000	3,467,870,000

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[1] Total exports of copper, exclusive of ore, concentrates, and composition metal, and for 1923-1930 of unrefined copper, figures for which are not separable from those for ore and concentrates. For 1926 and later years, exclusive also of "Other manufactures of copper," for which figures of quantity are not recorded.

[2] Includes old tailings.

PRODUCTION IN THE UNITED STATES

THREE SOURCES OF PRODUCTION STATISTICS

It is less true than formerly that the production of copper requires three operations—mining, smelting, and refining. All copper must be mined; but for years some Lake Superior copper has been smelted and sold as Lake copper without subsequent refining, and a steadily increasing amount of copper is being extracted from ores by leaching methods which render smelting unnecessary. Nevertheless, it is still practicable to determine the copper production of the United States by three distinct sets of statistics which may be obtained, respectively, from the mines, the smelters, and the refineries.

These separate determinations of production are desirable because each of them has for certain purposes a particular advantage over the others. As they show different aspects of production, the three sets of figures will never agree exactly, but taken together they afford complete data on the output of copper.

Details of the geographic distribution of output are shown more precisely by statistics of mine production than by those of smelter and refinery production. Likewise, the character of the ores produced, their contents of copper and other valuable metals, and the treatment, other than smelting, they may have undergone can be learned accurately only from the mines themselves. On the other hand, mine statistics show only the estimated recoverable metal content of the ores.

The actual percentage of crude copper recovered from copper ores and from other ores having a low content of copper is shown by the smelter statistics. Lead and zinc ores, siliceous ores of the precious metals, and pyrite roasted in the manufacture of sulphuric acid often carry so little copper that the mines are not paid for it and do not report it, although these sources as a whole yield a considerable amount of copper. Another cause of difference between the figures of mine and of smelter production is the lag in time between the production and the smelting of an ore. For example, most of the ore mined in December of any year is not represented in the figures of smelter production for that year but enters into the figures of the year following. A third cause of difference between these two sets of figures is that the amount of metal contained in ore, matte, and other material held in stock at smelters is rarely the same at the beginning and the end of a year. Smelter statistics, as well as mine statistics, show broadly the geographic distribution of output.

The precise amount of copper made available for consumption in a given period, as well as that of the precious metals recovered from crude copper, is shown only by refinery statistics, but these afford little information on the distribution of output according to source and are uncertain even in their classification of the material refined as foreign or domestic.

Differences between smelter and refinery statistics are similar in origin to those existing between mine and smelter statistics, as some time must elapse after the copper is smelted before it is refined; and the quantity of copper in stocks of untreated or unfinished material at the beginning of the year differs from that at the end, not only at smelters but at the refineries as well.

Two or three months usually elapse between the day ore is mined and the day the copper derived from it becomes available for commercial use. Hence, the refinery statistics for the calendar year 1930 represent approximately the ore mined between October, 1929, and October, 1930. In periods when the course of production is little disturbed by pronounced fluctuations of activity the three sets of statistics should not differ greatly, but any decided fall or rise in production between October of one year and March of the year following tends to accentuate the differences among the three sets of figures.

In these reports the smelter output, including that of furnace-refined Lake copper as well as blister copper, has been adopted as the production of the country, because smelter figures permit reasonably accurate determination of the distribution of copper production by States and also give the actual output of copper.

In order to have these figures maintain their value in showing the output of the country, it is necessary to include in them some copper produced directly through the leaching of ores and subsequent precipitation by electrolysis, although this fraction of the production is not actually smelted as is the cement copper precipitated from solutions by means of scrap iron. Since this electrolytically precipitated copper is very pure, refineries merely melt it in order to cast it in commercial forms.

SMELTER PRODUCTION

The copper output of the United States smelters from domestic ores in 1930 was 1,394,389,327 pounds, a drop of 608,473,808 pounds from the record output of 1929. The production in 1930 was 40 per cent of the world copper production. The United States percentage of the world total since 1913 has been as follows:

	Per cent		Per cent		Per cent
1913	56	1923	53	1927	50
1918	61	1924	55	1928	48
1920	57	1925	54	1929	48
1921	41	1926	54	1930	40
1922	50				

Copper produced in the United States from domestic ores, 1925–1930

[Smelter output, in pounds fine]

State	1925	1926	1927	1928	1929	1930
Alaska	72, 204, 166	67, 631, 846	56, 489, 214	40, 541, 968	39, 867, 940	36, 380, 038
Arizona	722, 653, 457	729, 324, 537	681, 168, 117	735, 632, 406	829, 206, 475	570, 897, 080
California	46, 943, 604	30, 442, 961	25, 802, 603	24, 707, 992	33, 084, 232	26, 262, 447
Colorado	3, 163, 211	4, 657, 591	8, 006, 801	10, 262, 083	10, 519, 784	12, 943, 857
Idaho	3, 144, 064	1, 171, 262	1, 811, 103	2, 336, 654	6, 267, 487	2, 713, 681
Michigan	138, 029, 764	174, 778, 884	195, 135, 199	179, 104, 311	185, 300, 917	142, 985, 522
Missouri	12, 114	54, 378	5, 041	930	1, 880	2, 198
Montana	270, 604, 676	257, 271, 936	225, 208, 853	251, 046, 415	299, 894, 873	198, 795, 853
Nevada	77, 137, 563	109, 041, 769	118, 298, 342	159, 332, 977	138, 990, 247	87, 475, 019
New Mexico	76, 467, 245	82, 848, 096	79, 761, 222	92, 777, 233	100, 165, 206	74, 187, 966
North Carolina		1, 468, 746	5, 362, 041	8, 207, 000	(1)	(1)
Oregon	126, 107	279, 223	484, 652	375, 049	739, 151	229, 753
Pennsylvania	562, 240	495, 698	2, 149, 182	5, 013, 868	3, 581, 393	3, 061, 174
Tennessee	19, 789, 234	18, 601, 586	14, 498, 951	16, 374, 261	(1)	(1)
Texas	785	17, 102	25, 460	432, 968	393, 740	165, 731
Utah	242, 730, 986	259, 649, 158	267, 705, 597	298, 375, 465	325, 965, 289	205, 769, 698
Vermont		446, 323	238, 143		752, 200	(1)
Washington	1, 184, 807	1, 336, 617	1, 766, 953	1, 197, 340	1, 569, 260	1, 404, 893
Wyoming	331			2, 575	4, 305	29, 356
Undistributed	115, 532	104, 381	123, 509	178, 898	26, 558, 776	31, 085, 031
	1, 674, 869, 886	1, 739, 622, 094	1, 684, 040, 983	1, 825, 900, 393	2, 002, 863, 135	1, 394, 389, 327

[1] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Copper produced (smelter output) in the United States, 1845–1930

[Values rounded]

Year	Quantity	Increase	Value	Year	Quantity	Increase	Value
	Pounds	*Pounds*			*Pounds*	*Pounds*	
1845	224,000	------------	$45,000	1889	226,775,962	414,496	$30,615,000
1846	336,000	112,000	57,000	1890	259,763,092	32,987,130	40,523,000
1847	672,000	336,000	124,000	1891	284,121,764	24,358,672	36,368,000
1848	1,120,000	448,000	218,000	1892	344,998,679	60,876,915	40,020,000
1849	1,568,000	448,000	349,000	1893	329,354,398	[1] 15,644,281	35,570,000
1850	1,456,000	[1] 112,000	320,000	1894	354,188,374	24,833,976	33,648,000
1851	2,016,000	560,000	334,000	1895	380,613,404	26,425,030	40,726,000
1852	2,464,000	448,000	542,000	1896	460,061,430	79,448,026	49,687,000
1853	4,480,000	2,016,000	985,000	1897	494,078,274	34,016,844	59,289,000
1854	5,040,000	560,000	1,108,000	1898	526,512,987	32,434,713	65,288,000
1855	6,720,000	1,680,000	1,814,000	1899	568,666,921	42,153,934	97,242,000
1856	8,960,000	2,240,000	2,419,000	1900	606,117,166	37,450,245	100,615,000
1857	10,752,000	1,792,000	2,688,000	1901	602,072,519	[1] 4,044,647	100,546,000
1858	12,320,000	1,568,000	2,833,000	1902	659,508,644	57,436,125	80,460,000
1859	14,112,000	1,792,000	3,104,000	1903	698,044,517	38,535,873	95,632,000
1860	16,128,000	2,016,000	3,709,000	1904	812,537,267	114,492,750	104,005,000
1861	16,800,000	672,000	3,696,000	1905	888,784,267	76,247,000	138,650,000
1862	21,160,000	4,360,000	4,655,000	1906	917,805,682	29,021,415	177,136,000
1863	19,040,000	[1] 2,120,000	6,473,000	1907	868,996,491	[1] 48,809,191	173,799,000
1864	17,920,000	[1] 1,120,000	8,422,000	1908	942,570,721	73,574,230	124,419,000
1865	19,040,000	1,120,000	7,473,000	1909	1,092,951,624	150,380,903	142,084,000
1866	19,936,000	896,000	6,828,000	1910	1,080,159,509	[1] 12,792,115	137,180,000
1867	22,400,000	2,464,000	5,682,000	1911	1,097,232,749	17,073,240	137,154,000
1868	25,984,000	3,584,000	5,976,000	1912	1,243,268,720	146,035,971	205,139,000
1869	28,000,000	2,016,000	6,790,000	1913	1,224,484,098	[1] 18,784,622	189,795,000
1870	28,224,000	224,000	5,977,000	1914	1,150,137,192	[1] 74,346,906	152,968,000
1871	29,120,000	896,000	7,023,000	1915	1,388,009,527	237,872,335	242,902,000
1872	28,000,000	[1] 1,120,000	9,956,000	1916	1,927,850,548	539,841,021	474,288,000
1873	34,720,000	6,720,000	9,721,000	1917	1,886,120,721	41,729,827	514,911,000
1874	39,200,000	4,480,000	8,624,000	1918	1,908,533,595	22,412,874	471,408,000
1875	40,320,000	1,120,000	9,152,000	1919	1,286,419,329	[1] 622,114,266	239,274,000
1876	42,560,000	2,240,000	8,937,000	1920	1,209,061,040	[1] 77,358,289	222,467,000
1877	47,040,000	4,480,000	8,937,000	1921	505,586,098	[1] 703,474,942	65,221,000
1878	48,160,000	1,120,000	7,994,000	1922	950,285,947	444,699,849	128,289,000
1879	51,520,000	3,360,000	9,582,000	1923	1,434,999,962	484,714,015	210,945,000
1880	60,480,000	8,960,000	12,943,000	1924	1,634,249,192	199,249,230	214,087,000
1881	71,680,000	11,200,000	13,046,000	1925	1,674,869,886	40,620,694	237,832,000
1882	90,646,232	18,966,232	17,313,000	1926	1,739,622,094	64,752,208	243,547,000
1883	115,526,053	24,879,821	19,062,000	1927	1,684,040,983	[1] 55,581,111	220,609,000
1884	144,946,653	29,420,600	18,843,000	1928	1,825,900,393	141,859,410	262,930,000
1885	165,875,483	20,928,830	17,915,000	1929	2,002,863,135	176,962,742	352,504,000
1886	157,763,043	[1] 8,112,440	17,512,000	1930	1,394,389,327	[1] 608,473,808	181,271,000
1887	181,477,331	23,714,288	25,044,000				
1888	226,361,466	45,440,942	38,029,000		44,448,876,489	------------	7,213,297,000

[1] Decrease.

The figures for smelter production in 1930 are based on confidential returns from all known smelting companies handling copper-bearing materials from the United States. Sincere thanks are extended to all companies and officials who have aided in furnishing this information and have given valuable time to answering inquiries concerning distribution of the output. The following list names the owning or operating companies, the location, and the final copper product of smelting and refining plants treating material from the United States during 1930. It does not include lead and zinc plants that recovered copper as a by-product from mixed ores. Lists of lead and zinc smelters may be found in the chapters on those metals.

Copper-reduction plants that treated materials from the United States in 1930

Location	Company	Final copper product
Arizona:		
Ajo	Calumet and Arizona Mining Co	Electrolytic.
Clarkdale	United Verde Copper Co	Blister.
Clemenceau	United Verde Extension Mining Co	Do.
Clifton	Phelps Dodge Corporation	Blister and casting.
Douglas	Calumet and Arizona Mining Co	Blister.
Do	Phelps Dodge Corporation	Do.
Hayden	American Smelting & Refining Co	Do.
Humboldt	Southwest Metals Co	Do.
Inspiration	Inspiration Consolidated Copper Co	Electrolytic.
Miami	International Smelting Co	Blister.
Superior	Magma Copper Co	Do.
Maryland: Baltimore	American Smelting & Refining Co	Electrolytic and casting.
Michigan:		
Hancock	Quincy Mining Co	Lake.
Houghton	Michigan Smelting Co	Do.
Hubbell	Calumet & Hecla Consolidated Copper Co	Do.
Montana:		
Anaconda	Anaconda Copper Mining Co	Blister.
Great Falls	do	Electrolytic.
Nevada: McGill	Nevada Consolidated Copper Co	Blister.
New Jersey:		
Chrome	United States Metals Refining Co	Blister and electrolytic.
Maurer	American Smelting & Refining Co	Do.
Perth Amboy	Raritan Copper Works	Electrolytic.
New York: Laurel Hill	Nichols Copper Co	Blister and electrolytic.
Tennessee:		
Copperhill	Tennessee Copper Co	Blister.
Isabella	Ducktown Chemical & Iron Co	Do.
Texas:		
El Paso	American Smelting & Refining Co	Do.
Do	Nichols Copper Co	Electrolytic.
Utah:		
Garfield	American Smelting & Refining Co	Blister.
International	International Smelting Co	Do.
Washington: Tacoma	American Smelting & Refining Co	Blister, electrolytic, and casting.

The figures of production represent the actual smelter recovery. For Michigan it is the sum of furnace-refined copper and copper cast into anodes for electrolytic refining. The figures for blister copper represent the fine copper content. Some casting and electrolytic copper is produced direct from ore or matte, and this is included in the smelter production. Metallic and cement copper recovered by leaching is also included in smelter production.

MINE PRODUCTION

The figures of mine production are based on reports furnished to the Bureau of Mines by all mines producing copper. The mines and smelters of several of the large copper producers are under the same management, and their production is reported on the same basis. The figures furnished by mines that ship to custom smelters or have only matting furnaces and ship their matte for conversion are likely to differ considerably from the smelter returns, as the mines may report a considerable quantity that has not reached the stage of blister copper by the end of the year and is consequently not included in the smelter production, or material that was reported by the mines in one year may be treated by the smelters in the following year. This discrepancy is more pronounced if a marked change in rate of production occurs at the beginning or the end of the year, so that there is not the balance of overlap that occurs if the industry is in normal condition throughout the year. Considerable copper is recovered by the smelters from ores that are treated primarily for other metals, the copper content being so low that it is not paid for and consequently is not always reported by the mines. The difference between the smelter and the refinery production is accounted for by change in the stocks of blister copper and bluestone and the loss in refining.

Although data on smelter and refinery production in a calendar year become available about the middle of the following year, figures on mine production seldom become available before the end of the year, as they are more difficult to obtain and require more time for computation.

Beginning with the 1929 chapter on Copper, such detailed figures on mine production as are available at the time of writing are used.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1921–1930, in pounds

Year	Mine	Smelter	Refinery
1920	1, 224, 550, 151	1, 209, 061, 040	1, 182, 423, 240
1921	466, 190, 853	505, 586, 098	609, 414, 256
1922	964, 583, 894	950, 285, 947	904, 670, 685
1923	1, 477, 739, 709	1, 434, 999, 962	1, 464, 164, 995
1924	1, 606, 165, 018	1, 634, 249, 192	1, 674, 214, 599
1925	1, 678, 117, 747	1, 674, 869, 886	1, 682, 895, 347
1926	1, 725, 275, 931	1, 739, 622, 094	1, 731, 297, 161
1927	1, 649, 959, 370	1, 684, 040, 983	1, 718, 952, 199
1928	1, 809, 796, 907	1, 825, 900, 393	1, 791, 797, 387
1929	1, 995, 110, 398	2, 002, 863, 135	1, 982, 732, 289
1930	1, 410, 147, 374	1, 394, 389, 327	1, 391, 224, 205

PRODUCTION BY STATES AND DISTRICTS

The mine and smelter production figures, by States, for 1929 and 1930 are shown in the following table; in the second table following the smelter production from 1845 through 1930, by States, is shown. Arizona, Utah, Montana, and Michigan led in production for 1930 with 80 per cent of the smelter output; if the production of Nevada, New Mexico, and Alaska is added to the output of these States, 94 per cent of the output of the country is represented. In total production from 1845 through 1930, Arizona, Montana, and Michigan are especially impressive, having yielded 32.59, 22.95, and 18.86 per cent, respectively, of the country's total output, and Utah stands fourth with 10.25 per cent; the four States together have produced 85 per cent of the total. If the production of Nevada, New Mexico, Alaska, and California is added to that of the four States mentioned, 97 per cent of the country's total output is represented.

Copper produced in the United States, 1929 and 1930, according to smelter and mine returns, by States, in pounds

State	1929		1930		
	Smelter returns	Mine returns	Smelter returns		Mine returns
			Percentage of total	Quantity	
Alaska	39,867,940	40,510,000	2.61	36,380,038	32 651,000
Arizona	829,206,475	830,628,411	40.94	570,897,080	576,190,607
California	33,084,232	33,218,994	1.88	26,262,447	27,285,272
Colorado	10,519,784	8,905,074	.93	12,943,857	10,514,000
Idaho	6,267,487	5,131,438	.20	2,713,681	3,111,555
Michigan	185,300,917	186,402,218	10.25	142,985,722	169,381,413
Missouri	1,880	2,240		2,198	176,600
Montana	299,894,853	297,725,973	14.26	198,795,883	196,187,523
Nevada	138,990,247	140,138,809	6.27	87,475,019	109,203,512
New Mexico	100,165,206	97,717,262	5.32	74,187,966	65,150,000
North Carolina	(1)	(1)	(1)	(1)	(1)
Oregon	739,151	655,746	.02	229,753	170,300
Pennsylvania	3,581,393	3,451,170	.22	3,061,174	2,859,675
Tennessee	(1)	(1)	(1)	(1)	(1)
Texas	393,740	341,000	.01	165,731	143,100
Utah	325,965,289	318,282,523	14.76	205,769,698	180,526,423
Vermont	752,200	(1)	(1)	(1)	(1)
Washington	1,569,260	1,400,489	.10	1,404,893	1,206,438
Wyoming	4,305	4,301		29,356	11,600
Undistributed	26,558,776	30,591,750	2.23	31,085,031	35,372,356
	2,002,863,135	1,995,110,398	100.00	1,394,389,327	1,410,147,374

[1] Included under "Undistributed." Bureau of Mines not at liberty to publish figures.

Copper produced in the United States, 1845–1930, by States

[Smelter output]

State	Pounds	Percentage	Rank
Alaska	1,193,975,195	2.69	7
Arizona	14,485,867,315	32.59	1
California	1,080,345,873	2.43	8
Colorado	352,296,459	.79	10
Idaho	142,212,408	.32	11
Michigan	8,382,282,360	18.86	3
Montana	10,203,234,659	22.95	2
Nevada	1,808,960,369	4.07	5
New Mexico	1,387,204,492	3.12	6
Oregon	20,608,876	.05	14
Tennessee	[1] 519,017,000	(2)	9
Utah	4,555,074,357	10.25	4
Washington	28,341,974	.06	13
Wyoming	31,709,373	.07	12
Other States and unapportioned	[3] 257,745,779	[3] .58	
	44,448,876,489		

[1] Approximate production through 1928. Figures for 1929 and 1930 are confidential and are included under "Other States and unapportioned."

[2] Bureau of Mines not at liberty to publish figures.

[3] Includes Tennessee for 1929 and 1930.

Mine production of copper in the principal districts, 1929 and 1930

[Districts that produced over 1,000,000 pounds]

District or region	State	1929		1930	
		Mine output (pounds)	Percentage of total production	Mine output (pounds)	Percentage of total production
Butte	Montana	296,316,000	14.85	195,472,000	13.87
Bingham	Utah	311,892,000	15.63	175,070,000	12.42
Lake Superior	Michigan	186,402,000	9.34	169,381,000	12.02
Globe-Miami	Arizona	191,596,000	9.60	158,120,000	11.22
Bisbee (Warren)	do	186,130,000	9.33	127,900,000	9.07
Yavapai County (mostly Jerome district).	do	208,172,000	10.43	117,690,000	8.35
Ely (Robinson)	Nevada	130,755,000	6.55	105,385,000	7.48
Central (including Santa Rita)	New Mexico	87,446,000	4.38	57,243,000	4.06
Ajo	Arizona	71,003,000	3.56	50,204,000	3.56
Morenci-Metcalf	do	56,781,000	2.85	43,144,000	3.06
Ray (Mineral Creek)	do	66,287,000	3.32	36,118,000	2.56
Pioneer	do	39,115,000	1.96	32,385,000	2.30
Plumas County	California	24,929,000	1.25	19,529,000	1.39
Banner	Arizona	5,040,000	.25	7,550,000	.54
Battle Mountain	Colorado	3,139,000	.16	5,849,000	.41
Lordsburg	New Mexico	4,248,000	.21	4,857,000	.34
Shasta County	California	6,034,000	.30	3,962,000	.28
Tintic	Utah	3,166,000	.16	2,862,000	.20
Lebanon (Cornwall mine)	Pennsylvania	3,454,000	.17	2,860,000	.20
Jack Rabbit	Nevada	2,638,000	.13	1,995,000	.14
Foothill belt	California	1,210,000	.06	1,857,000	.13
Park City	Utah	2,524,000	.13	1,678,000	.12
Willow Creek	New Mexico	2,641,000	.13	1,438,000	.10
Eureka	Colorado	1,616,000	.08	1,410,000	.10
Battle Mountain	Nevada	2,432,000	.12	1,305,000	.09
Animas	Colorado	(1)	----------	1,268,000	.09
Bonanza	do	2,667,000	.13	1,234,000	.09
Index	Washington	1,296,000	.06	1,143,000	.08
Alder Creek	Idaho	2,824,000	.14	1,122,000	.08
Yerington	Nevada	3,270,000	.16	(1)	----------
Silver Bell	Arizona	2,384,000	.12	(1)	----------
Pastura	New Mexico	1,500,000	.08	(1)	----------
Burro Mountain	do	1,085,000	.05	(1)	----------
Copper River [2]	Alaska	(3)	(3)	(3)	(3)
Prince William Sound [2]	do	(3)	(3)	(3)	(3)
Swain County [2]	North Carolina	(3)	(3)	(3)	(3)
Ducktown [2]	Tennessee	(3)	(3)	(3)	(3)

[1] Less than 1,000,000 pounds.
[2] Not listed in order of output.
[3] Not at liberty to publish figures.

Copper produced in some of the principal districts to the end of 1930

District or region	State	Date production began	Pounds	Per cent	Rank
Butte	Montana	1868	10, 130, 584, 000	22. 79	1
Lake Superior	Michigan	1845	8, 370, 155, 000	18. 83	2
Bingham	Utah	1896	4, 110, 224, 000	9. 25	3
Bisbee	Arizona	1880	4, 069, 942, 000	9. 16	4
Globe-Miami	do	1881	3, 289, 189, 000	7. 40	5
Jerome	do	1883	(1)	(1)	6
Morenci-Metcalf	do	1873	1, 935, 206, 000	4. 35	7
Ely (Robinson)	Nevada	1908	1, 647, 674, 000	3. 71	8
Central (including Santa Rita)	New Mexico	1800	1, 212, 320, 000	2. 73	9
Ray (Mineral Creek)	Arizona	1911	1, 121, 198, 000	2. 52	10
Ajo	do	(2)	[3] 721, 059, 000	1. 62	11
Shasta County	California	1897	637, 576, 000	1. 43	12
Ducktown	Tennessee	1850	(4)	(4)	13
Pioneer	Arizona	(2)	[5] 292, 042, 000	. 66	14
Plumas County	California	1865	264, 678, 000	. 60	15
Tintic	Utah	1880	184, 874, 000	. 42	16
Foothill belt	California	1862	175, 426, 000	. 39	17

[1] Bureau of Mines not at liberty to publish figures for Jerome district separately for 1924–1930. The total through 1923 was 1,556,324,000 pounds. The output of Yavapai County (mostly Jerome district) for 1924–1930 was 1,085,534,000 pounds.

[2] Not recorded.

[3] From 1907–1930, inclusive.

[4] Bureau of Mines not at liberty to publish figures for Ducktown district separately for 1929 and 1930. The total through 1928 was 519,562,000 pounds.

[5] From 1904–1930, inclusive.

QUANTITY AND ESTIMATED RECOVERABLE CONTENT OF COPPER-BEARING ORES

The following tables show the quantity and the estimated recoverable copper content of the ore produced by the mines of the United States in 1926 to 1929. The figures are taken from the mine reports in Mineral Resources. Detailed figures for 1930 are not available at time of writing. The close agreement between the output as reported by the smelters and the recoverable quantity as reported by the mines indicates that the estimated recoverable tenor is very close to the actual recovery. The classification of some of the complex western ores is difficult and more or less arbitrary. Under copper ores are classed not only those that contain 2.5 per cent or more of copper but those that contain less than this percentage if they are valuable chiefly for copper. Under copper-lead and copper-lead-zinc ores are classed complex ores in which copper is a valuable constituent. Mines report considerable copper from ores mined primarily for other metals. These include siliceous gold and silver ores, lead ores, zinc ores, pyritic sulphur ores, and ores concentrated for their content of other metals.

Copper produced in the United States in 1929 from ores, old tailings, etc., in which copper constitutes the principal value

State	Copper ore, old tailings, etc. (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore
		Pounds	Per centage			
Alaska	590,400	40,510,000	3.43	-------------	351,730	$0.32
Arizona	25,669,975	[1] 815,180,681	1.59	179,488.76	6,598,986	.28
California	1,080,355	33,190,562	1.54	20,041.03	547,183	.65
Colorado	36,539	3,045,195	4.17	2,974.72	784,933	13.13
Idaho	91,782	3,777,080	2.06	2,371.41	68,410	.93
Michigan	7,598,180	186,402,218	1.23	-------------	20,795	[2] .39
Montana	3,802,976	[3] 288,233,547	3.79	31,030.94	7,289,007	1.19
Nevada	6,572,404	137,666,757	1.05	65,287.67	255,254	.23
New Mexico	4,114,187	92,995,631	1.13	17,300.12	270,385	.12
North Carolina	(4)	(4)	(4)	(4)	(4)	(4)
Oregon	3,836	653,225	8.51	234.89	6,890	2.22
Tennessee	[5] 930,258	[5] 30,591,750	1.64	[5] 745.02	[5] 105,663	.08
Texas	1,456	86,200	2.96	-------------	2,671	.98
Utah	17,895,332	[6] 301,318,708	.84	137,353.04	1,608,570	.21
Vermont	(4)	(4)	(4)	(4)	(4)	(4)
Washington	34,145	1,393,769	2.04	189.20	32,377	.62
Wyoming	28	4,301	7.68	-------------	19	.36
Total and average	68,421,853	1,935,049,624	1.41	457,016.80	17,942,873	.28

[1] Excludes 13,233,543 pounds of copper from mine-water precipitates.

[2] Calculated only on ore that yielded silver.

[3] Excludes 6,464,032 pounds of copper from mine-water precipitates.

[4] Figures included under Tennessee. Bureau of Mines not at liberty to publish separately.

[5] Includes totals for North Carolina and Vermont. Bureau of Mines not at liberty to publish separately.

[6] Excludes 4,591,482 pounds of copper from mine-water precipitates and 2,221,423 pounds of copper from ore leached in place.

Copper produced in the United States, 1926–1928, from ores in which copper constitutes the principal value

State	1926		1927		1928	
	Copper ore (short tons)	Copper produced (pounds)	Copper ore (short tons)	Copper produced (pounds)	Copper ore (short tons)	Copper produced (pounds)
Alaska	670,000	[1] 67,778,000	645,000	55,343,000	579,500	41,421,000
Arizona	22,030,481	[2] 718,448,062	[3] 21,674,826	[4] [5] 676,549,738	22,583,844	[6] 718,442,138
California	831,583	29,698,574	785,366	24,690,901	900,791	[6] 24,751,199
Colorado	2,126	315,152	467	54,313	11,983	1,299,636
Idaho	28,258	586,387	27,742	1,030,348	31,454	1,058,944
Michigan	7,641,682	175,381,565	8,046,334	177,537,775	7,361,658	178,442,704
Missouri	50	44,000	------------	------------	------------	------------
Montana	2,825,081	[2] 239,039,406	2,929,557	[5] 212,995,742	3,147,671	[6] 236,897,019
Nevada	4,888,681	[2] 100,529,055	4,885,052	[5] 118,477,899	6,244,047	156,746,489
New Mexico	3,644,936	81,242,662	3,124,447	[7] 71,491,246	3,733,442	[8] 87,257,916
North Carolina	15,150	1,468,700	38,400	5,443,115	73,330	8,207,000
Oregon	5,632	293,411	16,214	486,480	4,577	357,041
Tennessee	608,040	18,606,664	630,955	14,940,595	759,995	16,374,261
Texas	61	9,100	------------	------------	4,494	221,713
Utah	13,949,866	[2] [9] 239,141,740	13,879,173	[5] [10] 238,232,386	16,631,757	[6] [11] 276,691,243
Vermont	14,970	473,200	4,363	208,224	------------	------------
Washington	25,297	1,348,545	37,564	1,684,450	28,560	1,165,342
Wyoming	------------	------------	------------	------------	29	2,604
	57,181,894	1,674,404,223	56,725,460	1,599,166,212	62,097,132	1,749,336,249

[1] Includes a small quantity from lead ore.

[2] Excludes copper from mine-water precipitates, as follows: Arizona, 2,350,343 pounds; Montana, 5,044,108 pounds; Nevada, 341,843 pounds; Utah, 1,132,550 pounds.

[3] Includes 6,695 tons of old tailings.

[4] Includes copper from 6,695 tons of old tailings.

[5] Excludes copper from mine-water precipitates, as follows: Arizona, 4,412,437 pounds; Montana, 4,515,407 pounds; Nevada, 189,554 pounds; Utah, 1,221,328 pounds.

[6] Excludes copper from mine-water precipitates, as follows: Arizona, 11,509,594 pounds; California, 206,160 pounds; Montana, 6,701,580 pounds; Utah, 2,229,541 pounds.

[7] Includes 222,605 pounds of copper recovered from leaching of a waste dump.

[8] Includes 387,042 pounds of copper recovered from leaching of a waste dump.

[9] Excludes 5,054,499 pounds of copper from ore leached in place.

[10] Excludes 4,825,587 pounds of copper from ore leached in place.

[11] Excludes 3,978,236 pounds of copper from ore leached in place.

Copper ores, old tailings, etc., concentrated, copper ores leached and smelted, and copper produced in the United States by each method in 1929

State	Ore, old tailings, etc., concentrated			
	Short tons	Concentrates produced (short tons)	Copper produced (pounds)	Percentage of copper from ore
Alaska	(1)	(1)	(1)	(1)
Arizona	18, 164, 803	1, 047, 128	414, 615, 081	1. 14
California	954, 565	62, 220	28, 990, 663	1. 52
Idaho	75, 697	5, 701	2, 627, 639	1. 74
Michigan	7, 598, 180	[2] 143, 292	[3] 186, 402, 218	1. 23
Montana	3, 666, 578	627, 241	276, 474, 282	3. 77
Nevada	6, 417, 494	380, 435	128, 839, 532	1. 00
New Mexico	3, 973, 300	152, 027	84, 645, 000	1. 07
North Carolina	(1)	(1)	(1)	(1)
Tennessee	[4] 1, 075, 003	[4] 103, 696	[4] 42, 518, 266	[4] 1. 98
Utah	17, 768, 469	475, 194	293, 605, 026	. 83
Vermont	(1)	(1)	(1)	(1)
Washington	33, 447	1, 878	1, 232, 600	1. 84
Total and average	59, 727, 536	2, 998, 812	1, 459, 950, 307	1. 22

State	Ore leached			Ore smelted		
	Short tons	Copper produced (pounds)	Percentage of copper	Short tons	Copper produced (pounds)	Percentage of copper
Alaska				(1)	(1)	(1)
Arizona	4, 335, 742	82, 103, 623	0. 95	3, 165, 287	318, 174, 479	5. 03
California				37, 513	3, 534, 673	4. 71
Colorado				36, 539	3, 045, 195	4. 17
Idaho				16, 085	1, 149, 441	3. 57
Montana	2, 040	91, 952	2. 25	105, 435	9, 657, 554	4. 58
Nevada				154, 910	8, 827, 225	2. 85
New Mexico				140, 887	8, 350, 631	2. 96
North Carolina				(1)	(1)	(1)
Oregon				3, 836	653, 225	8. 51
Tennessee				[5] 445, 655	[5] 28, 583, 484	[5] 3. 21
Texas				1, 456	86, 200	2. 96
Utah	(6)	(6)	(6)	126, 863	7, 713, 682	3. 04
Washington				698	161, 169	11. 55
Wyoming				28	4, 301	7. 68
Total and average	4, 337, 782	82, 195, 575	. 95	4, 235, 192	389, 941, 259	4. 60

[1] Figures included under Tennessee.
[2] Includes concentrates from sands.
[3] Includes copper from sands.
[4] Includes totals for Alaska, North Carolina, and Vermont.
[5] Includes totals for Alaska and North Carolina.
[6] Ore leached in place yielded 2, 221, 423 pounds of copper; quantity of ore unknown.

Copper ores concentrated and smelted and copper produced in the United States by each method, 1926–1928

State	Ore concentrated					
	1926		1927		1928	
	Short tons	Copper produced (pounds)	Short tons	Copper produced (pounds)	Short tons	Copper produced (pounds)
Alaska	649,750	[1] 43,182,739	629,736	37,959,263	568,362	28,506,231
Arizona	17,800,347	410,065,457	[2] 14,983,108	[3] 355,901,387	15,793,494	382,361,648
California	788,320	26,768,333	730,681	21,452,353	748,839	21,140,805
Idaho	26,799	455,636	26,562	910,599	30,144	938,799
Michigan	7,641,682	[4] 175,381,565	8,046,334	[4] 177,537,775	7,361,658	[4] 178,442,704
Montana	2,684,887	225,441,875	2,821,196	203,034,611	3,064,863	229,039,043
Nevada	4,756,591	93,428,646	4,755,216	109,193,609	6,081,808	144,351,889
New Mexico	3,523,319	74,035,200	2,982,137	64,461,564	3,596,144	79,205,042
North Carolina	----------	----------	----------	----------	12,150	1,642,000
Oregon	5,155	227,691	16,018	439,716	2,800	70,300
Tennessee	286,996	10,796,413	334,982	7,948,735	364,494	7,461,570
Utah	13,880,100	233,465,293	13,811,500	232,284,968	16,561,500	271,951,582
Vermont	14,970	473,200	4,363	208,224	----------	----------
Washington	24,868	1,220,990	37,202	1,598,437	28,229	1,083,683
	52,083,784	1,294,943,038	49,179,035	1,212,931,241	54,214,485	1,346,195,296

State	Ore smelted					
	1926		1927		1928	
	Short tons	Copper produced (pounds)	Short tons	Copper produced (pounds)	Short tons	Copper produced (pounds)
Alaska	20,250	24,595,261	15,264	17,383,737	11,138	12,914,769
Arizona	2,899,971	286,923,832	2,552,903	252,671,006	2,674,321	267,182,958
California	43,263	2,930,241	54,685	3,238,548	151,952	3,610,394
Colorado	2,126	315,152	467	54,313	11,983	1,299,636
Idaho	1,459	130,751	1,180	119,749	1,310	120,145
Missouri	50	44,000	----------	----------	----------	----------
Montana	140,194	13,597,531	108,361	9,961,131	82,808	7,857,976
Nevada	132,090	7,100,409	129,836	9,284,290	161,989	12,387,073
New Mexico	121,617	7,207,462	142,310	6,807,077	137,298	8,052,874
North Carolina	15,150	1,468,700	38,400	5,443,115	61,180	6,565,000
Oregon	477	65,720	196	46,764	1,777	286,741
Tennessee	321,044	7,810,251	295,973	6,991,860	395,501	8,912,691
Texas	61	9,100	----------	----------	4,494	221,713
Utah	69,766	5,676,447	67,673	5,947,418	70,257	4,739,661
Washington	429	127,555	362	86,013	331	81,559
Wyoming	----------	----------	----------	----------	29	2,604
	3,767,947	358,002,412	3,407,610	318,035,021	3,766,368	334,235,894

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[1] Includes a small quantity from lead ore.
[2] Includes 6,695 tons of old tailings concentrated.
[3] Includes copper from 6,695 tons of old tailings concentrated.
[4] Includes copper from sands.

Copper produced from copper-lead and copper-lead-zinc ores in the United States in 1929

State	Copper-lead and copper-lead-zinc ores (short tons)	Copper produced (pounds)	Percentage of copper	State	Copper-lead and copper-lead-zinc ores (short tons)	Copper produced (pounds)	Percentage of copper
Arizona	19,908	290,538	0.73	New Mexico	2,367	152,308	3.22
California	24	1,661	3.46	Texas	20	2,000	5.00
Colorado	81	7,285	4.50	Utah	44,219	883,605	1.00
Idaho	84,138	379,062	.23				
Montana	51,725	505,408	.49				
Nevada	56,644	2,322,866	2.05	Total and average	259,126	4,544,733	.88

Copper produced from ores, old tailings, etc., classed as copper-bearing (copper, copper-lead, and copper-lead-zinc ores) and total production of copper from all sources in the United States in 1929

State	From copper, copper-lead, and copper-lead-zinc ores, old tailings, etc.			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Ore treated (short tons)	Copper produced (pounds)	Percentage of copper	
Alaska	590,400	40,510,000	3.43	40,510,000
Arizona [1]	25,689,883	815,471,219	1.59	830,628,411
California	1,080,379	33,192,223	1.54	33,218,994
Colorado [2]	36,620	3,052,480	4.17	8,905,074
Idaho	175,920	4,156,142	1.18	5,131,438
Michigan	7,598,180	186,402,218	1.23	186,402,218
Missouri				2,240
Montana [1]	3,854,701	288,738,955	3.75	297,725,973
Nevada	6,629,048	139,989,623	1.06	140,138,809
New Mexico	4,116,554	93,147,939	1.13	97,717,262
North Carolina	(3)	(3)	(3)	(3)
Oregon	3,836	653,225	8.51	655,746
Pennsylvania				3,454,170
Tennessee	[4] 930,258	[4] 30,591,750	1.64	[4] 30,591,750
Texas	1,476	88,200	2.99	341,000
Utah [1]	17,939,551	302,202,313	.84	318,282,523
Vermont	(3)	(3)	(3)	(3)
Washington	34,145	1,393,769	2.04	1,400,489
Wyoming	28	4,301	7.68	4,301
Total and average	68,680,979	1,939,594,357	1.41	1,995,110,398

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[1] Considerable copper was recovered from mine-water precipitates and from ores not classed as copper ores.

[2] Much of the copper from Colorado was derived in 1929 from ores classed as siliceous ores and lead-zinc ores.

[3] Figures included under Tennessee. Bureau of Mines not at liberty to publish separately.

[4] Includes totals for North Carolina and Vermont. Bureau of Mines not at liberty to publish separately.

Copper produced from ores classed as copper-bearing (copper, copper-lead, and copper-lead-zinc ores) and total production of copper from all sources in the United States, 1926–1928

State	1926			1927			1928		
	From copper, copper-lead, and copper-lead-zinc ores		Copper from all sources, including old slags, smelter cleanings, and precipitates	From copper, copper-lead, and copper-lead-zinc ores		Copper from all sources, including old slags, smelter cleanings, and precipitates	From copper, copper-lead, and copper-lead-zinc ores		Copper from all sources, including old slags, smelter cleanings, and precipitates
	Ore treated	Copper produced		Ore treated	Copper produced		Ore treated	Copper produced	
	Short tons	*Pounds*	*Pounds*	*Short tons*	*Pounds*	*Pounds*	*Short tons*	*Pounds*	*Pounds*
Alaska	670, 000	[1] 67, 778, 000	67, 778, 000	645, 000	55, 343, 000	55, 343, 000	579, 500	41, 421, 000	41, 421, 000
Arizona [2]	22, 055, 501	719, 424, 088	723, 296, 051	21, 686, 756	676, 729, 022	682, 190, 547	22, 605, 927	718, 733, 936	732, 276, 803
California	831, 966	29, 720, 699	33, 466, 299	785, 559	24, 704, 287	27, 133, 008	900, 928	24, 760, 366	25, 150, 743
Colorado	2, 223	323, 277	3, 403, 850	877	62, 597	5, 670, 581	12, 349	1, 322, 752	8, 594, 646
Idaho	50, 295	702, 511	1, 337, 442	67, 867	1, 294, 747	2, 173, 163	80, 776	1, 236, 313	2, 072, 165
Michigan	7, 641, 682	175, 381, 565	175, 381, 565	8, 046, 334	177, 537, 775	177, 537, 775	7, 361, 658	178, 442, 704	178, 442, 704
Missouri	50	44, 000	1, 077, 000			451, 000			65, 000
Montana [2]	3, 049, 403	240, 689, 583	255, 372, 862	3, 193, 425	214, 568, 948	223, 492, 639	3, 340, 510	237, 701, 810	248, 262, 027
Nevada	4, 898, 832	101, 123, 855	101, 827, 937	4, 910, 356	119, 801, 203	120, 259, 276	6, 284, 376	158, 581, 618	158, 876, 883
New Mexico	3, 644, 941	81, 242, 912	81, 642, 379	3, 127, 340	71, 641, 954	74, 251, 863	3, 733, 442	87, 257, 916	89, 854, 646
North Carolina	15, 150	1, 468, 700	1, 468, 700	38, 400	5, 443, 115	5, 443, 115	73, 330	8, 207, 000	8, 207, 000
Oregon	5, 632	293, 411	296, 454	16, 214	486, 480	488, 200	4, 577	357, 041	358, 463
Pennsylvania			1, 018, 536			1, 735, 800			4, 977, 885
Tennessee	608, 040	18, 606, 664	18, 606, 664	630, 955	14, 940, 595	14, 940, 595	759, 995	16, 374, 261	16, 374, 261
Texas	61	9, 100	12, 620			21, 458	4, 494	221, 713	447, 792
Utah [2]	13, 949, 866	239, 141, 740	257, 464, 482	13, 953, 051	240, 451, 102	256, 933, 278	16, 677, 112	277, 884, 688	293, 235, 039
Vermont	14, 970	473, 200	473, 200	4, 363	208, 224	208, 224			
Washington	25, 297	1, 348, 545	1, 351, 890	37, 564	1, 684, 450	1, 685, 848	29, 260	1, 176, 389	1, 177, 246
Wyoming							29	2, 604	2, 604
	57, 463, 909	1, 677, 771, 850	1, 725, 275, 931	57, 144, 061	1, 604, 897, 499	1, 649, 959, 370	62, 448, 263	1, 753, 682, 111	1, 809, 795 907

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[1] Includes a small quantity of copper from lead ore.

[2] Considerable copper was recovered from mine-water precipitates and from ores not classed as copper ores.

Copper ores produced in the United States, 1920–1929, and average yield in copper gold, and silver

Year	Smelting ores		Concentrating ores		Total				
	Short tons	Yield in copper (per cent)	Short tons	Yield in copper (per cent)	Short tons	Yield in copper (per cent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1920	3,200,509	4.89	31,348,340	1.34	36,765,370	1.63	0.0047	0.331	$0.46
1921	1,235,602	4.77	11,022,544	1.44	13,396,382	1.70	.0039	.357	.44
1922	2,278,047	5.36	23,158,970	1.43	26,893,247	1.74	.0049	.386	.49
1923	3,496,728	5.12	40,269,754	1.29	45,519,317	1.58	.0060	.321	.39
1924	3,554,915	5.08	44,427,164	1.33	49,178,315	1.59	.0063	.325	.35
1925	3,876,733	4.90	48,186,769	1.28	53,103,014	1.54	.0065	.338	.37
1926	3,767,947	4.75	52,083,784	1.24	57,181,894	1.46	.0064	.293	.31
1927	3,407,610	4.67	49,179,035	1.23	56,715,460	1.41	.0065	.255	.28
1928	3,766,368	4.44	54,214,485	1.24	62,097,132	1.41	.0067	.236	.28
1929	4,235,192	4.69	[1] 59,727,536	1.22	[1] 68,421,853	1.41	.0067	.262	.28

[1] Includes old tailings, etc.

REVIEW BY STATES AND COMPANIES

SCOPE OF DISCUSSION

This section summarizes the conditions affecting production in the principal copper districts of the country. More detailed information on the mining operations of the districts is given in the chapters on mine production.

In this report the individual companies' figures for metal output, ore reserves, metal content, and recovery in treatment, unless otherwise stated, are quoted from the published official reports of the companies. The chapter on Copper in Mineral Resources for 1915 contains a map showing the location of the copper-producing districts and the metallurgical plants and a brief discussion of the geologic occurrence of the ores in the several districts.

In 1930 the American Smelting & Refining Co. had available for dividends, after all charges, taxes, bond interest, depreciation, and depletion were deducted, a net income of $11,098,751 compared with $21,831,583 in 1929. Statistics on the company's operations for several years are given in the following table:

Operations of the American Smelting & Refining Co., 1926–1930

	1926	1927	1928	1929	1930
PRODUCTION					
Gold ounces	1,634,158	1,479,899	1,407,286	1,461,215	1,760,702
Silver do	85,482,438	80,671,759	81,434,214	89,098,293	[1] 85,515,993
Lead short tons	469,607	476,988	471,880	545,100	[1] 497,832
Copper do	525,897	536,830	563,713	619,398	[1] 440,784
Zinc do	48,723	52,170	47,433	54,510	[1] 66,040
OPERATING STATISTICS					
Number of men employed	28,612	27,363	26,757	30,253	23,971
Charge smelted short tons	5,433,547	4,643,306	4,330,508	4,620,185	3,911,470
Bullion refined do	990,295	1,004,196	1,038,030	1,151,605	911,004
Coal used do	413,351	413,366	416,351	415,745	366,919
Coke used do	508,033	492,171	386,478	401,435	329,455
Fuel oil used barrels	1,836,923	1,627,258	1,706,651	1,765,408	1,388,277
Gas used cubic feet	6,223,869,000	6,402,907,000	5,158,775,000	5,562,375,000	7,032,444,000
Ore mined short tons	1,875,991	2,234,880	2,482,998	2,493,569	2,059,598
Coal mined do	749,646	810,329	738,483	809,844	812,480
Coke produced do	360,270	366,909	340,893	369,636	322,753

[1] Including metal treated for account of others.

ALASKA

The output of blister copper from Alaska ores was 36,380,038 pounds in 1930, a decrease from 39,867,940 pounds in 1929. The 1930 production raised Alaska's total recorded production to 1,193,975,195 pounds (2.69 per cent of the country's total from 1845 to 1930). Alaska remained in seventh place in 1930 among the copper-producing States. In smelter production for 1930 Alaska continued to rank seventh also, with 2.61 per cent of the total production of the country.

Prince William Sound.—The Beatson mine of the Kennecott Copper Corporation produced 444,799 tons of ore, having an average copper content of 1.12 per cent and 0.233 ounce of silver per ton. The mill treated the entire tonnage, yielding 25,958 tons of concentrates, with a copper content of 16.07 per cent—a recovery of 83.66 per cent. In 1929 the production amounted to 452,962 tons of ore, averaging 1.28 per cent of copper; it yielded 33,091 tons of concentrates, averaging 14.47 per cent of copper—a recovery of 82.64 per cent.

Copper River district.—At Kennecott 58,493 tons of ore were produced, containing an average of 14.62 per cent of copper and 2.46 ounces of silver per ton. Of this quantity 52,480 tons were treated at the mill at Kennecott and yielded 11,638 tons of concentrates with an average content of 40.95 per cent of copper—a recovery of 95.11 per cent. In 1929 79,955 tons of ore, containing an average of 11.86 per cent of copper, were mined at Kennecott.

At the property of the Mother Lode Coalition Mines Co., 27,486 tons of ore were produced, containing an average of 20.31 per cent of copper and 3.24 ounces of silver per ton. Shipments to the smelter totaled 9,179 tons, containing 9,646,800 pounds of copper and 75,004 ounces of silver.

ARIZONA

Arizona is the most important copper-producing State, both in production for 1930 and in total production for the country from 1845 through 1930. In 1930 Arizona produced 570,897,080 pounds of copper (40.94 per cent of the total for the United States); Montana, the nearest competitor in total production through 1930, produced 14.26 per cent of the country's total in 1930. Arizona's total production through 1930 is 14,485,867,315 pounds (32.59 per cent of the total United States production); Montana has produced 22.95 per cent of the United States total and Michigan 18.86 per cent. Arizona came into the lead in total production in 1920. In 1919 Montana stood first, with 27.59 per cent of the total production, and Arizona was a close second, with 27.45 per cent. Among the six most important States in the output of copper, Arizona is the only one whose production is not made almost entirely from one district.

Bisbee district.—The Bisbee district produced more copper from 1845 through 1930 than any other district in Arizona, but since 1916 its output has been exceeded by that of other districts of the State; it ranked third in 1929 and second in 1930. Among the copper-producing districts of the United States, Bisbee, with a total recorded production through 1930 of 4,069,942,000 pounds of copper, is exceeded only by the Butte, Lake Superior, and Bingham districts. In 1930 Bisbee ranked fifth among the districts of this country, with a production of 127,900,000 pounds of copper.

Copper produced in Bisbee district, Arizona, 1921-1930, in pounds

1921	37, 249, 000	1926	140, 668, 000
1922	79, 591, 000	1927	138, 595, 000
1923	123, 884, 000	1928	161, 492, 000
1924	140, 630, 000	1929	186, 130, 000
1925	145, 433, 000	1930	127, 900, 000

The Phelps Dodge Corporation, its branches and subsidiaries, produced ores in 1930 that yielded the following metals: Copper, 141,662,995 pounds; lead, 151,413 pounds; silver, 768,334 ounces; gold, 20,839 ounces; and manganese, 12,620 pounds. Its purchased ores yielded 2,190,257 pounds of copper, 4,971,874 pounds of lead, 799,056 ounces of silver, and 3,200 ounces of gold.

At the Copper Queen branch copper production from the limestone mines decreased materially from the 1929 figures because of depressed market conditions. Development work amounted to 22,146 feet; also, 12,018 feet of underground diamond drilling and 4,434 feet of surface churn drilling were done. The Southeast extension ore body produced 560,871 tons of ore in 1930, the largest tonnage in its history, which yielded 23,833,969 pounds of copper, compared with 17,201,165 pounds of copper in 1929. Sacramento Hill (West ore body) produced 605,675 tons of ore from shovel and glory-hole mining; 512,427 tons of this total were milling ore, and 93,248 tons were smelting ore. The milling and smelting ore yielded 18,739,837 pounds of copper, 54,644 ounces of silver, and 2,645 ounces of gold. These figures indicate a decrease in ore output and a general decrease in metals obtained. The copper department of the concentrator milled 1,089,910 dry tons of ore, with an average grade of 1.84 per cent of copper, a marked decrease in tonnage and a decrease of 0.31 point in average grade. Because of the lower grade of the ore treated during 1930 it was necessary to raise the ratio of concentration from 6.58 into 1 in 1929 to 7.13 into 1 in 1930. The recovery of total copper was 89.25 per cent, compared with 91.32 in 1929. Total shipments from the Don Luis precipitation plant to the smelter contained more than 11,522,204 pounds of gross copper; leaching operations still continued good, and the apparent recovery from the precipitation plant was 97.54 per cent. A small plant near the Holbrook shaft was put in operation in 1928 for the treatment of the acid Czar mine water and enriched liquors from underground leaching in the Holbrook division; in 1930 a total of 558,703 pounds of copper was produced, with a recovery of 88.89 per cent. The reduction plant at Douglas produced 101,704,411 pounds of copper, 844,626 ounces of silver, and 19,787 ounces of gold from 620,055 tons of material smelted.

Metals produced by Copper Queen branch of Phelps Dodge Corporation, 1921–1930

Year	Ore	Copper	Silver	Gold	Lead	Zinc
	Short tons	*Pounds*	*Ounces*	*Ounces*	*Pounds*	*Pounds*
1921	515,632	30,610,173	495,179	4,650	4,916,418	----------
1922	389,367	47,962,123	1,132,304	11,972	8,560,525	247,793
1923	1,189,570	87,935,334	935,729	19,151	6,307,412	610,709
1924	2,022,196	109,117,018	906,521	29,850	6,094,613	----------
1925	1,940,737	116,379,978	1,079,733	32,007	7,103,853	----------
1926	1,921,021	109,269,035	907,292	35,382	3,868,259	----------
1927	1,838,665	106,351,930	781,989	32,651	4,031,433	----------
1928	1,785,739	115,570,399	684,006	32,711	4,277,156	----------
1929	2,058,231	127,605,697	625,795	34,149	2,259,967	----------
1930	1,475,296	84,195,921	433,666	19,202	233,696	----------

Metals produced by Copper Queen branch of Phelps Dodge Corporation in 1930

	Ore, dry weight	Gold	Silver	Copper	Lead	Manganese
Underground limestone ores:						
Copper—	*Short tons*	*Ounces*	*Ounces*	*Pounds*	*Pounds*	*Pounds*
Company	224,153	8,415	208,539	22,224,051	----------	----------
Lease	55,729	4,886	97,293	6,881,855	----------	----------
	279,882	13,301	305,832	29,105,906	----------	----------
Lead—						
Company	250	8	1,572	554	85,630	----------
Lease	729	19	2,290	21,393	148,066	----------
	979	27	3,862	21,947	233,696	----------
Manganese—						
Lease	317	----------	----------	----------	----------	12,620
Porphyry ores:						
West ore body—						
Glory hole—						
Smelting	93,248	562	10,383	2,857,099	----------	----------
Milling	512,427	2,083	44,261	15,882,738	----------	----------
	605,675	2,645	54,644	18,739,837	----------	----------
East ore body—						
Southeast extension—						
Smelting	1,866	9	43	106,034	----------	----------
Milling	559,005	3,172	68,001	23,727,935	----------	----------
	560,871	3,181	68,044	23,833,969	----------	----------
North block—						
Milling	18,151	48	995	372,771	----------	----------
Precipitates:						
West ore body—						
Company	8,873	----------	264	11,522,204	----------	----------
Lease	74	----------	6	40,584	----------	----------
Holbrook	474	----------	19	558,703	----------	----------
	9,421	----------	289	12,121,491	----------	----------
	1,475,296	19,202	433,666	84,195,921	233,696	12,620

The Calumet and Arizona Mining Co. produced from ores and concentrates from all sources 88,839,719 pounds of copper in 1930, compared with 130,486,607 pounds in 1929. The sulphuric acid plant was operated throughout the year, producing more than 46,000 tons of 60° B. acid. The company did 56,011 feet of development work compared with 62,939 feet in 1929. Increased ore reserves in the Campbell ore body were reported from the 1,500 level to the 2,300 level, and new bodies of ore have been discovered in the Junction area. The mines at Bisbee produced 427,436 wet tons of ore, averaging 5.17 per cent of copper, compared with 5.09 per cent during 1929.

Metals[1] *produced by Calumet and Arizona Mining Co., 1921–1930*

Year	Refined copper produced	Gold	Silver	Dividends
	Pounds	*Ounces*	*Ounces*	
1921	17,855,613	12,365	419,647	$1,285,043
1922	30,830,615	23,349	642,174	1,285,047
1923	42,166,930	35,093	824,768	2,248,849
1924	41,582,030	31,934	813,791	1,285,063
1925	44,557,219	37,287	832,434	2,571,028
1926	45,553,208	35,554	972,650	3,856,542
1927	48,164,083	33,556	1,015,450	3,856,542
1928	51,732,822	37,605	1,248,700	4,499,299
1929[2]	127,139,117	54,672	1,688,376	8,185,503
1930[2]	87,380,170	42,553	1,284,596	1,685,714

[1] Exclusive of metals produced from purchased ores.

[2] Includes operations of New Cornelia Copper Co., Ajo district, which was consolidated with Calumet & Arizona Mining Co. in April, 1929, to form Calumet and Arizona Mining Co. (See p. 725).

The Denn mine of the Shattuck Denn Mining Corporation produced 8,333,787 pounds of copper in 1930 at a net operating cost of 10.21 cents per pound. In addition, 646,273 pounds were recovered in cleaning up the stope areas. The total was obtained from 76,219 dry tons of ore, from which the average recovery amounted to 0.063 ounce of gold, 1.93 ounces of silver, and 5.89 per cent copper. Operations were curtailed on May 1 and continued on a partial production basis until the end of September, when they ceased. The Shattuck mine was operated on development work and produced 968,160 pounds of copper from ore encountered. Development work consisted of 4,645 feet of drifting, raising, and diamond drilling in the Shattuck and 11,693 feet in the Denn. In the Denn the development work was practically confined to the 2,100 and 2,200 levels.

Metals produced by Shattuck Denn Mining Corporation, 1921–1930[1]

[Shattuck Arizona Copper Co. prior to 1925]

Year[1]	Copper (from copper ores)	Silver (from copper ores)	Gold (from copper ores)	Lead recovered	Copper recovered
	Pounds	*Ounces*	*Ounces*	*Pounds*	*Per cent*
1921[2]	287,928	12,093	29	----------	7.94
1923	3,223,209	157,124	1,349	1,590,682	6.42
1924	2,630,185	72,671	754	5,244,526	6.44
1925	1,828,699	34,246	633	3,757,811	5.52
1926	3,045,518	46,905	960	5,798,362	6.56
1927	4,145,711	36,359	719	5,011,837	6.88
1928	4,936,831	55,141	810	1,548,363	5.56
1929	12,733,741	241,423	5,516	28,760	(³)
1930	9,948,220	(³)	(³)	----------	(³)

[1] No production in 1922.

[2] Results of development work only. No productive operations carried on.

[3] Figures not available.

Globe-Miami district.—The Globe-Miami district was formerly the most important copper-producing district in Arizona; it ranks second in Arizona to the Bisbee district in total production for the period from 1845 through 1930, with a total recorded output of 3,289,189,000 pounds. In total output the Globe-Miami ranks fifth among the copper-producing districts of the country, and in output for 1930 it ranks fourth. The district produced 158,120,000 pounds of copper in 1930 compared with 191,596,000 in 1929.

Copper produced in Globe-Miami district, Arizona, 1921–1930, in pounds

1921	76, 488, 000	1926	175, 386, 000
1922	170, 035, 000	1927	171, 167, 000
1923	198, 426, 000	1928	160, 430, 000
1924	190, 452, 000	1929	191, 596, 000
1925	175, 272, 000	1930	158, 120, 000

The Old Dominion Co. mined 470,327 tons of ore in 1930, compared with 415,891 tons in 1929. The grade was 2.27 per cent copper in 1930 and 2.65 per cent in 1929. The refined copper produced in 1930 aggregated 17,596,795 pounds, compared with 18,943,441 pounds in 1929. The smelting ore came from the lower levels on the west side and has been exhausted. Development work amounted to 27,590 feet; the new ore discovered was of a lower grade than that in 1929; thus, the tenor of the reserves was reduced from 2.4 per cent copper at the end of 1929 to 2.1 per cent at the end of 1930. The company reported an increase of 444,610 tons of new ore, containing 8,000,000 pounds of recoverable copper, in reserve tonnage for the year. Further development work between the twenty-second and twenty-sixth levels disclosed the large body of concentrating ore which has materially increased reserves. The development campaign for 1931 will be centered on the 2,400, 2,500, and 2,600 foot levels.

The following results were obtained at the concentrator:

Mill statistics, Old Dominion Co., 1929 and 1930

	1929	1930		1929	1930
Copper assay of heads per cent	2. 61	2. 29	Copper assay of tails per cent	0. 279	0. 239
			Extraction do	89. 9	89. 31
Copper assay of concentrates per cent	18. 97	26. 05	Ratio of concentration	8. 10 to 1	12. 76 to 1

Metals produced by Old Dominion Co., 1921–1930 [1]

Year	Ore	Refined Copper	Gold	Silver	Average grade of ore in copper
	Short tons	*Pounds*	*Ounces*	*Ounces*	*Per cent*
1921	61, 753	7, 389, 648	1, 187	71, 155	5. 31
1922	202, 954	18, 573, 289	3, 317	122, 095	5. 14
1923	289, 695	26, 764, 801	5, 137	190, 033	4. 95
1924	294, 999	25, 400, 670	5, 531	155, 814	4. 62
1925	355, 623	27, 283, 655	5, 752	150, 782	4. 16
1926	362, 213	25, 425, 833	7, 040	149, 235	3. 94
1927	356, 697	21, 570, 615	(2)	(2)	3. 42
1928	353, 392	17, 717, 267	(2)	(2)	2. 92
1929	415, 891	18, 943, 441	(2)	(2)	2. 65
1930	470, 327	17, 596, 795	(2)	(2)	2. 27

[1] Includes custom metals produced.

[2] Not given.

The Miami Copper Co. mill treated 6,124,993 tons of ore (an average of 17,141 tons per day), compared with 5,017,983 tons in 1929. The ore averaged 0.72 per cent in 1930 and 0.83 per cent in 1929. The concentrates obtained in 1930 averaged 34.127 per cent of copper, compared with an average of 36.241 per cent in 1929. Underground development work amounted to 77,430 feet, compared with 131,360 feet in 1929. From the concentrates 67,124,596 pounds of refined copper were obtained in 1930, compared with 58,841,159 pounds in 1929. The cost of producing copper during the year was 10.878 cents per pound, and the average sales price was 14.87 cents. On January 1, 1931, the ore reserves were as follows:

Ore reserves of Miami Copper Co., January 1, 1931

	Short tons	Per cent copper	
		Total	Soluble
Sulphide ore	84, 276, 787	0. 88	0. 09
Mixed ore	7, 000, 000	1. 83	1. 34

Copper produced by Miami Copper Co., 1921–1930

Year	Ore	Copper content	Mill extraction	Refined copper	Dividends
	Short tons	*Per cent*	*Per cent*	*Pounds*	
1921	1, 868, 757	1. 758	85. 37	53, 311, 941	$1, 494, 228
1922	2, 183, 020	1. 883	86. 36	67, 454, 447	1, 494, 228
1923	2, 380, 155	1. 697	83. 98	64, 448, 245	1, 494, 228
1924	2, 444, 079	1. 624	80. 17	60, 475, 547	1, 494, 228
1925	2, 919, 600	1. 287	72. 60	51, 851, 274	933, 893
1926	3, 793, 207	. 979	76. 77	55, 289, 174	840, 505
1927	4, 116, 255	. 855	77. 64	53, 038, 218	1, 120, 674
1928	4, 260, 599	. 853	68. 41	48, 259, 448	1, 120, 674
1929	5, 017, 983	. 830	72. 80	58, 841, 159	2, 614, 906
1930	6, 124, 993	. 716	78. 88	67, 124, 596	1, 774, 401

Milling operations of Miami Copper Co. in 1930

Ore milled	short tons	6, 124, 993
Copper in ore	per cent	0. 716
Concentrates produced	short tons	101, 388
Copper in concentrates	per cent pounds	34. 127 69, 200, 620
Copper recovered per ton of ore	do	11. 30
Mill extraction	per cent	78. 88

Cost of copper in concentrates f. o. b. cars at Miami, Ariz., in 1930

	Per ton of ore	Per pound of copper
Mining	$0. 39594	0. 03613
Milling	. 29671	. 02708
General	. 13911	. 01269
	. 83176	. 07590

During 1930 the Inspiration Consolidated Copper Co. mined 3,041,854 tons of ore, as follows:

Ore mined by the Inspiration Consolidated Copper Co. in 1930

	Short tons	Per cent copper
Concentrating and smelting ores	406,831	1.115
Leaching ores	2,635,023	1.241
	3,041,854	1.224

Copper produced by the Inspiration Consolidated Copper Co. in 1930

	Ore treated	Copper produced
	Tons	*Pounds*
Inspiration division concentrating ores	8,092	131,861
Live Oak division concentrating ores	365,085	7,030,599
Live Oak division smelting ores	119	1,785
Inspiration division leaching ores	830,316	18,647,559
Live Oak division leaching ores	1,850,418	39,794,860
	3,054,030	65,606,664
Less adjustments for purchased copper and soluble anode inventory		343,131
Net production available for sale		65,263,533

During the year 373,177 tons of ore averaging 1.112 per cent copper were milled, the concentrator being closed after June 8, 1930. The ores were mined at the rate of 15.064 tons per man-shift, as compared with 11.313 tons in 1929. The total development work carried on underground consisted of 68,191 feet of workings and 2,997 cubic yards of miscellaneous excavation, together with 1,411 feet of diamond drilling, 140 feet of churn drilling, and 95 feet of shaft sinking. During the year 2,518,974 tons of ore containing 1.216 per cent copper were charged into the leaching tanks. The average extraction of total copper amounted to 90.726 per cent. The cost of copper, excluding depletion and Federal taxes, was given in the company's annual statement as 9.6671 cents per pound. The production of copper was 65,606,664 pounds, obtained from 3,054,030 dry tons of ore.

Metallurgical results at Inspiration Consolidated Copper Co.'s leaching plant

	Per cent
Leaching plant:	
Feed—total copper	1.208
Oxide copper content of feed	.658
Sulphide copper content of feed	.550
Oxide copper extraction	96.960
Sulphide copper extraction	83.273
Total copper extraction	90.728
Slimes treatment—combined flotation and leaching:	
Feed—total copper	1.664
Oxide copper content of feed	1.289
Sulphide copper content of feed	.375
Oxide copper extraction	95.578
Sulphide copper extraction	72.800
Total copper extraction	90.445

The over-all extractions on total ore treated since commencement of slimes leaching were as follows:

	Per cent
Oxide copper	96. 875
Sulphide copper	82. 649
Total copper extraction	90. 726

The Iron Cap Copper Co. did not operate its mine near Globe in 1930 but milled 182,241 dry tons and shipped 34,363 tons of smelting ore at Christmas. Total copper produced and sold from the mine at Christmas amounted to 6,924,735 pounds. The new mill at Christmas was completed in June, 1929, and operated continuously during 1930. The mill heads averaged 2.036 per cent copper, and an extraction of 80.52 per cent was made. The new ore body, disclosed on the 800-foot level during 1929 after the shaft was unwatered and proving the presence of ore zones below the 500-foot level, was further opened up. The Iron Cap Co. controls 75 per cent of the stock in the Christmas Copper Co. property.

The Arizona Commercial Mining Co. produced 64,870 tons of ore containing 3.30 per cent copper in 1930, compared with 62,085 tons averaging 3.57 per cent in 1929. From the ore in 1930 were obtained 3,644,877 pounds of copper, 18,042 ounces of silver, and 474 ounces of gold. The property was sold to the Old Dominion Co. in November, 1930, but was not turned over to that company until December, after all payable broken ore had been drawn from the stopes.

Copper, gold, and silver produced by the Arizona Commercial Mining Co., 1921–1930

Year	Refined copper	Gold	Silver	Year	Refined copper	Gold	Silver
	Pounds	*Ounces*	*Ounces*		*Pounds*	*Ounces*	*Ounces*
1921	572, 616	163	3, 001	1926	5, 985, 607	1, 444	34, 614
1922	6, 220, 923	1, 585	27, 532	1927	5, 505, 448	1, 157	32, 664
1923	8, 115, 212	2, 143	37, 826	1928	4, 665, 605	793	29, 074
1924	7, 760, 931	1, 883	32, 634	1929	3, 800, 456	596	21, 010
1925	7, 860, 866	1, 972	39, 430	1930	3, 644, 877	474	18, 042

Morenci-Metcalf district.—The copper production of the Morenci-Metcalf district amounted to 43,144,000 pounds, compared with 56,781,000 pounds in 1929. In total output through 1930 the district ranks seventh among the copper-producing districts of the United States.

Copper produced in Morenci-Metcalf district, Arizona, 1921–1930, in pounds

1921	11, 420, 000	1926	63, 950, 000
1922	14, 175, 900	1927	59, 760, 000
1923	28, 735, 000	1928	54, 053, 000
1924	41, 047, 000	1929	56, 781, 000
1925	59, 464, 000	1930	43, 144, 000

The Morenci branch of the Phelps Dodge Corporation mined 1,363,116 dry tons of ore, of which 1,321,268 tons were from the Humboldt mine and 41,848 tons were from outlying claims. The total development work, excluding diamond drilling but including drift, winzes, raises, drill, and stope developments, amounted to 31,627 feet. The concentrator treated 1,346,233 dry tons of ore and produced 114,563 tons of concentrates. The mill changes which were begun in 1928 were completed in 1930. The Clifton smelter treated

137,748 tons of new metal-bearing material during the year and produced 42,618,265 pounds of salable copper of which 43.4 per cent was ingots.

Yavapai County.—The output of copper in Yavapai County, mostly from the Jerome district, in 1930 and in several preceding years is given in the table that follows. From the beginning of operations through 1930 Jerome ranks sixth among the country's copper-producing districts. The chief producers of the district are the United Verde Copper Co. and the United Verde Extension Mining Co.

Copper produced in Yavapai County, Ariz., 1921–1930, in pounds

1921	26, 576, 298	1926	155, 368, 000
1922	76, 607, 502	1927	141, 642, 000
1923	147, 718, 492	1928	165, 297, 000
1924	143, 348, 230	1929	208, 172, 000
1925	154, 017, 340	1930	117, 690, 000

During 1930 the United Verde Extension Mining Co. produced 301,562 tons of ore from its mine, averaging 6.65 per cent of copper, 1.27 ounces of silver, and 0.038 ounce of gold. Of this ore, 251,849 tons were shipped to the smelter; the average yield was 7.40 per cent of copper, 1.34 ounces of silver, and 0.039 ounce of gold. The copper produced at Clemenceau amounted to 43,632,823 pounds. The company also shipped silica ore yielding 1,934,405 pounds of copper. It completed 13,135 feet of raises and drifts and did 6,301 feet of diamond drilling. At the end of 1930 the reserves amounted to 600,000 tons of ore averaging about 7 per cent of copper. The cost was 8.49 cents per pound, exclusive of depreciation, taxes, and reserve to return capital (depletion). The company distributed dividends amounting to $3,150,000, or $3.00 per share.

Cost[4] of producing copper by United Verde Extension Mining Co. in 1930

	Cents per pound
Mining	2. 84
Smelting and concentrating	2. 32
Freight on ore	. 08
Freight on bullion, refining, selling	1. 79
Custom ore purchased	1. 06
Other expenses	. 40
	8. 49

Copper produced by the United Verde Extension Mining Co., 1921–1930

Year	Ore treated	Copper produced	Silver	Gold
	Short tons	*Pounds*	*Ounces*	*Ounces*
1921	53, 643	12, 498, 005	112, 864	2, 328
1922	136, 980	31, 640, 714	238, 764	5, 788
1923	172, 629	41, 855, 959	257, 602	8, 992
1924	185, 858	44, 278, 947	(a)	(a)
1925	[b] 183, 309	[c] 43, 720, 324	(a)	(a)
1926	198, 911	43, 041, 576	(a)	(a)
1927	[b] 248, 799	[c] 41, 301, 930	(a)	(a)
1928	[b] 246, 477	[c] 45, 200, 041	(a)	(a)
1929	[b] 343, 115	[c] 64, 111, 931	(a)	(a)
1930	[b] 265, 092	[c] 45, 567, 228	(a)	(a)

[a] Figures not available. [b] Includes custom ore and concentrates smelted.
[c] Includes copper from custom ore and concentrates smelted.

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[4] Exclusive of depreciation, reserve to return capital (depletion), and taxes.

The mines and plants of the United Verde Copper Co. were active continuously throughout 1930. The Verde Central mine operated until September 30, 1930, when operation ceased because of the low price of copper. The property was sold to the United Verde in July, 1931, for a reported price of $250,000.

Ray or Mineral Creek district.—In 1930 the Ray district produced 36,118,000 pounds of copper. The total recorded output of the district through 1930 is 1,121,198,000 pounds; it continued to rank tenth among the copper-producing districts of the country.

At the Ray mines of the Nevada Consolidated Copper Co. 2,327,100 tons of copper ore were treated in 1930, compared with 3,609,100 tons in 1929. Further data for the Ray mines have been blanketed under the main company, the Nevada Consolidated Copper Co., as given under Nevada (p. 732).

Copper produced by the Ray mines of the Nevada Consolidated Copper Co., Arizona, 1921–1930

Year	Ore milled	Copper content	Mill recovery	Refined copper
	Short tons	*Per cent*	*Per cent*	*Pounds*
1921	406, 172	1. 646	77. 82	10, 110, 131
1922	1, 178, 350	1. 587	76. 66	27, 953, 408
1923	2, 689, 800	1. 571	74. 87	61, 385, 205
1924	2, 896, 700	1. 523	78. 27	67, 017, 981
1925	3, 037, 700	1. 500	84. 45	74, 691, 091
1926	2, 957, 200	(1)	(1)	(1)
1927	2, 830, 100	(1)	(1)	(1)
1928	3, 234, 600	(1)	(1)	(1)
1929	3, 609, 100	(1)	(1)	(1)
1930	2, 327, 100	(1)	(1)	(1)

[1] Not given separately. In 1926 the copper content of Ray, Nevada, and Chino production was 1.268 per cent, mill recovery 86.26 per cent, and refined copper output 231,119,539 pounds; in 1927 copper content was 1.326 per cent, mill recovery 87.92 per cent, and refined copper output 218,683,930 pounds; in 1928 copper content was 1.363 per cent, mill recovery 86.56 per cent, and refined copper output 268,462,629 pounds; in 1929 copper content was 1.257 per cent, mill recovery 84.74 per cent, and refined copper output 266,274,918 pounds; in 1930 copper content was 1.213 per cent, mill recovery 86.66 per cent, and refined copper output 141,980,173 pounds.

Ajo district.—The Ajo district produced 50,204,000 pounds of copper during 1930, compared with 71,003,000 pounds in 1929. The total production from 1907 to 1930, inclusive, amounted to 721,059,000 pounds, placing Ajo eleventh among the producing districts of the United States.

The New Cornelia mines of the Calumet and Arizona Mining Co. produced 3,460,632 wet tons of ore and waste. Of this total, 1,916,932 dry tons of ore, containing 1.24 per cent copper, were sent to the concentrator; 459,832 dry tons, containing 0.878 per cent copper, were sent to the leaching plant; 548,934 dry tons, containing 0.323 per cent copper, were sent to the sulphide waste dump; and 491,676 dry tons, containing 0.354 per cent copper, were sent to the carbonate waste dump. A total of 1,906,955 dry tons of sulphide ore was treated at the concentrating plant, a daily average of 6,508 tons, and 459,832 dry tons of carbonate ore were treated at the leaching plant, a daily average of 2,527 tons. The leaching plant was closed on June 21. The yield of metals is combined with that of the Calumet and Arizona Mining Co. (p. 718). Continued development work, principally drilling, has disclosed further ore.

Copper produced by the New Cornelia Copper Co., 1926–1930, in pounds[1]

	1926	1927	1928
Electrolytic copper	17,405,991	72,932,670	77,995,281
Cement copper	836,282		
Copper from concentrates	64,070,190		
	82,312,463	72,932,670	77,995,281

[1] Company consolidated with Calumet & Arizona Mining Co. in April, 1929, as the Calumet and Arizona Mining Co. and production in 1929 and 1930 included with that of latter company (see p. 718).

Pioneer district.—The Pioneer district produced 32,385,000 pounds of copper in 1930, compared with 39,115,000 pounds in 1929. The total production from 1904 to 1930, inclusive, has amounted to 292,042,000 pounds.

The Magma Copper Co. mined 251,872 tons of ore in 1930, averaging 6.90 per cent of copper, 3.31 ounces of silver, and 0.033 ounce of gold. At the smelter concentrates and ore treated during the year yielded 31,884,271 pounds of copper, 937,383 ounces of silver, and 10,154 ounces of gold. The mill heads averaged 6.46 per cent of copper, and the recovery was 97.94 per cent. Development work amounted to 18,005 feet.

CALIFORNIA

In California production of blister copper decreased from 33,084,232 pounds in 1929 to 26,262,447 pounds in 1930. California remained in eighth place in total production from the beginning of operations, the total output being 1,080,345,873 pounds (2.43 per cent of the country's total).

The Engels Copper Mining Co. produced 4,072,628 pounds of copper in 1930, compared with 11,000,162 pounds in 1929. In addition, 44,471 ounces of silver and 495 ounces of gold were produced in 1930. The total production of copper since the beginning of operations by the company in 1914 has reached 159,980,668 pounds. The grade of the ore mined in 1930 was 1.297 per cent of copper, compared with 1.524 per cent in 1929. The ore reserves decreased from 327,844 tons, averaging 1.75 per cent, in 1929 to 138,105 tons of about the same grade in 1930. The mill treated 176,680 tons of ore, assaying 1.289 per cent of copper; the yield was 14,083,851 pounds of concentrates, which assayed 28.92 per cent of copper.

Cost of producing copper by Engels Copper Mining Co. in 1930

		Total	Per pound of copper
			Cents
Operating cost		$442,981.04	10.8770
Freight and smelting charges	$188,868.45		
Credit value of gold and silver recovered	26,453.08		
		162,415.37	3.9880
Operating and marketing cost		605,396.41	14.8650
Depreciation costs		81,914.29	2.0113
Development and exploration		115,179.26	2.8281
Shutdown expense		15,046.50	.3695
		817,536.46	20.0739

Operations at Superior mill in 1930

Ore milled	short tons	176,680
Average heads	per cent	1.2891
Average tails	do	.11695
Actual extraction	do	88.86
Concentrates produced	pounds	14,083,851
Average content of concentrates	per cent	28.92
Copper produced	pounds	4,072,628
Silver produced	ounces	44,471.52
Gold produced	do	495.34

Ore reserves of Engels and Superior mines, December 31, 1930, in short tons

Mine	Blocked ore		Probable ore	Total
	In place	Broken in stopes		
Engels	78,092	55,818		133,910
Superior		3,195	1,000	4,195
	78,092	59,013	1,000	138,105

Operations by the Walker Mining Co., a subsidiary of Anaconda, were continuous throughout the year; 495,108 tons of ore were broken, 530,529 tons produced, and 518,509 tons treated in the concentrator, yielding 33,266 tons of concentrates. The concentrates averaged 23.77 per cent of copper and the mill heads 1.67 per cent. The company sold to the smelter 33,251 tons of concentrates, which yielded 15,776,171 pounds of fine copper, 377,766 ounces of silver, and 16,462 ounces of gold. The concentrator made an average recovery of 91.06 per cent.

COLORADO

Colorado continued to hold tenth place among the copper-producing States of the country in total recorded production through 1930, with an output of 352,296,459 pounds (0.79 per cent of the country's total). In 1930 the production amounted to 12,943,857 pounds, as compared with 10,519,784 pounds in 1929; much of the output was obtained as a by-product from siliceous ores and lead-zinc ores. To date no highly important copper mine has been opened in the State.

IDAHO

In 1930 the production of blister copper from Idaho amounted to 2,713,681 pounds, compared with 6,267,487 pounds in 1929, and the State ranked thirteenth among the copper-producing States. The total output from Idaho through 1930 was 142,212,408 pounds, and the State continues to rank eleventh.

MICHIGAN

Lake Superior district.—In the production of copper from the beginning of operations through 1930 Michigan ranks third among the States, with 8,382,282,360 pounds (18.86 per cent of the country's total output of 44,448,876,489 pounds). The 1930 smelter production amounted to 142,985,522 pounds (10.25 per cent of the country's total), compared with 185,300,917 pounds in 1929 (9.25

per cent of the country's total). The Lake Superior district ranks second only to the Butte district in total mine output through 1930, having produced 8,370,155,000 pounds, compared with 10,130,584,000 pounds from the Butte district. In 1930 the Lake Superior district ranked third in mine output, with 169,381,000 pounds of copper.

Copper ore produced in Lake Superior district, Michigan, 1921–1930

Year	Short tons	Yield of copper (per cent)	Year	Short tons	Yield of copper (per cent)
1921	3, 610, 648	1. 20	1926	7, 641, 682	1. 15
1922	4, 952, 264	1. 23	1927	8, 046, 334	1. 10
1923	5, 363, 160	1. 29	1928	7, 361, 658	1. 21
1924	5, 372, 572	1. 26	1929	7, 598, 180	1. 23
1925	7, 036, 751	1. 10	1930	6, 659, 036	1. 27

As reported by the Calumet & Hecla Consolidated Copper Co. its mines produced 87,898,000 pounds of copper in 1930 at an average cost of 10.56 cents per pound, including cost of selling but no charges for depreciation and depletion, compared with 90,319,000 pounds costing 11.43 cents per pound in 1929. In addition, the reclamation plants at Lake Linden and Hubbell recovered 17,842,000 pounds of copper at an average cost sold of 6.71 cents per pound, compared with 33,511,000 pounds at a cost of 5.62 cents in 1929. The Calumet mill treated 841,731 tons of conglomerate and 169,356 tons of Osceola amygdaloid; the Ahmeek mill treated 1,193,704 tons of Kearsarge and 571,884 tons of Osceola amygdaloid. The smelter received 85,000 tons of concentrates and mass copper and smelted 75,900 tons, all of which came from the mines and mills of the company; the yield of refined copper was 90,260,000 pounds, 73.5 per cent of that refined during the previous year.

Operations at the Calumet & Hecla reclamation plants at Lake Linden and Hubbell in 1930 and for the entire period of their operation

	1930	Since starting
Quantity treated .... short tons	1, 545, 000	24, 768, 000
Assay headings .... per cent	0. 665	0. 680
Assay tailings .... do	. 086	. 137
Refined copper produced .... pounds	17, 842, 000	268, 641, 000
Refined copper produced per ton treated .... do	11. 55	10. 85

The comparative results of operations during the past four years by the Isle Royale Copper Co. are summarized as follows:

Copper produced by the Isle Royale Copper Co., 1927–1930

	1927	1928	1929	1930
Rock hoisted .... short tons	593, 594	560, 598	669, 049	668, 700
Rock-house discard .... do	128, 494	119, 867	154, 025	158, 438
Rock treated .... do	465, 100	440, 731	515, 024	510, 262
Cost of mining, transportation, stamping, and taxes per ton of rock	$2. 50	$2. 71	$2. 67	$2. 44
Refined copper produced .... pounds	11, 391, 338	10, 520, 771	10, 864, 085	10, 659, 413
Refined copper per ton of rock treated .... do	24. 49	23. 87	21. 09	20. 89

The Champion, Baltic, and Trimountain mines produced 23,793,918 pounds of refined copper in 1930, of which 13,799,988 pounds were for the Copper Range Co.; one-half of the output of the Champion belongs to the St. Mary's Mineral Land Co. From the part controlled by Copper Range, excluding that assigned to the St. Mary's Mineral Land Co., 304,089 tons of rock were stamped, yielding an average of 45.38 pounds of copper per ton, compared with 43.33 pounds per ton in 1929.

The Champion Copper Co. stamped about 450,000 tons of rock from the Champion mine, from which copper totaling 19,999,564 pounds was obtained, or an average yield of 44.57 pounds per ton. A total of 16,510 feet of development work was completed during 1930, and considerable diamond drilling was done. About 65,000 tons of material from the Baltic mine were stamped, yielding 3,251,705 pounds of copper, or 49.72 pounds per ton. About 2,334 feet of development work were done in the mine. About 14,000 tons of material from the Trimountain mine were stamped, yielding 542,649 pounds of copper, or 37.81 pounds per ton.

Copper produced by the Champion Copper Co., 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net profits
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	531,780	20,719,307	39.018	9.82	13.329	$719,955.51
1922	503,593	19,583,806	38.964	9.93	14.359	890,515.16
1923	449,130	18,412,630	41.03	11.14	14.86	738,871.98
1924	457,160	20,061,630	43.88	10.49	13.76	709,276.53
1925	414,645	17,957,605	43.308	11.73	14.258	497,764.43
1926	454,654	17,658,820	38.84	10.83	13.948	597,042.27
1927	403,260	16,098,926	39.92	10.84	13.42	455,791.07
1928	427,240	19,563,535	45.79	11.10	15.01	829,357.45
1929	446,804	20,660,701	46.24	11.76	17.94	1,267,685.97
1930	(2)	19,999,564	44.57	11.60	11.43	[3] 32,955.04

[1] Excludes depreciation and depletion. [2] Figures not given. [3] Deficit.

Copper produced by the Baltic mine, 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net loss
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	195,816	7,608,847	38.86	14.15	13.078	$81,668.95
1922	165,804	5,329,568	32.14	16.76	13.958	149,578.09
1923	137,801	4,877,248	35.51	18.42	14.626	189,880.94
1924	150,101	4,769,286	31.77	15.95	13.76	104,574.24
1925	140,958	4,255,069	30.18	17.74	14.25	148,517.14
1926	126,157	3,690,041	29.25	18.28	13.94	160,073.52
1927	121,504	4,207,819	34.63	13.50	13.42	3,120.98
1928	92,742	3,415,082	36.82	14.54	15.01	[2] 16,085.53
1929	53,833	2,127,926	39.53	21.27	17.94	62,339.97
1930	(3)	3,251,705	49.72	11.82	11.43	(3)

[1] Excludes depreciation and depletion. [2] Net profit. [3] Figures not given.

Copper produced by the Trimountain mine, 1921–1930

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received	Net loss
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*	
1921	143,172	4,341,584	30.32	18.27	13.078	$183,560.50
1922	130,913	4,116,100	31.44	16.47	13.95	67,576.58
1923	6,273	281,482	44.87	(2)	14.62	140,563.74
1924	8,159	278,259	34.10	(2)	13.76	87,053.47
1925	35,465	1,065,044	30.03	(2)	14.25	39,302.47
1926	63,837	2,177,416	34.11	13.43	13.94	[3] 11,253.16
1927	67,281	2,354,808	35.00	12.25	13.42	[3] 27,476.86
1928	38,950	1,275,515	32.74	16.90	15.01	24,100.34
1929	42,763	1,408,689	32.94	22.92	17.94	57,968.20
1930	(2)	542,649	37.81	16.38	11.43	(2)

[1] Excludes depreciation and depletion. [2] Figures not given. [3] Net profit.

The Mohawk Mining Co. produced 484,910 tons of rock, of which 472,623 tons were stamped. The rock stamped produced 18,778,400 pounds of mineral of which only 3,582,500 pounds, yielding 2,706,762 pounds of refined copper, were sent to the smelter. The rock treated averaged 28.155 pounds of copper to the ton, compared with 32.349 pounds in 1929. The total cost of delivered refined copper during the year was reported by the company as 8.724 cents per pound. During the year the company did 3,450 feet of development work of all classes at the Mohawk mine. About 78 per cent of the ore stamped during 1930 came from No. 6 shaft and the remainder from No. 1.

Copper produced by the Mohawk Mining Co. in 1930

Rock hoisted	short tons	484,910
Rock stamped	do	472,623
Product of mineral	pounds	18,778,400
Mineral smelted	do	3,582,500
Refined copper produced	do	2,706,762
Yield per ton of rock treated [5]	do	28.155
Estimated copper in mineral on hand	do	10,600,000
Cost per ton of rock hoisted [5]		$1.900
Cost per ton of rock stamped [5]		$1.949
Operating cost per pound of refined copper [5]	cents	6.924
Cost of taxes [5]	do	.442
Cost of smelting, freight, and marketing product, including eastern offices' expenses [5]	cents	1.358
		8.724

The Quincy Mining Co. produced 18,042,927 pounds of mineral yielding 10,939,787 pounds of refined copper in 1930. Operations were normal until the end of July, when curtailment was begun on a 5-day-week basis. During this period the mine was being prepared for stoping on the retreating system. In this work 13,480 feet of stope development were done, and the copper rock thus removed yielded about 24.27 pounds of copper per ton. During the last five months only 3,020 feet of stope development were done. Costs were reduced to less than 10 cents per pound.

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[5] Estimated because of storage of mineral.

Copper produced by the Quincy Mining Co., 1924–1930

Year	Copper rock and mass	Mineral	Copper	Yield of copper per ton of rock
	Short tons	*Pounds*	*Pounds*	*Pounds*
1924	588, 100	24, 489, 920	14, 838, 633	25. 24
1925	586, 913	22, 721, 380	14, 357, 523	24. 46
1926	517, 900	20, 220, 795	13, 290, 052	25. 66
1927	413, 000	15, 336, 690	9, 718, 662	23. 53
1928	60, 834	1, 891, 200	1, 220, 536	20. 06
1929	207, 833	7, 088, 500	4, 459, 426	21. 46
1930	[1] 450, 800	18, 042, 927	10, 939, 787	24. 27

[1] Not given in company report but indicated by other figures.

MISSOURI

During 1930 Missouri produced 2,198 pounds of blister copper, compared with 1,880 pounds in 1929.

MONTANA

Among the copper-producing States, Montana stands second only to Arizona in total recorded production through 1930, but in output for 1930 Montana ranked third among the copper-producing States. The smelter output of the State was 198,795,883 pounds in 1930 (14.26 per cent of the Nation's total), and the total output through 1930 is 10,203,234,659 pounds (22.95 per cent of the country's total). Montana has only one outstanding copper-producing district—the Butte.

Butte district.—The Butte district continues as the leading district in the United States in total production of copper since the beginning of operations. Through 1930 Butte has produced a total of 10,130,584,000 pounds of copper; it produced 195,472,000 pounds in 1930, compared with 296,316,000 pounds in 1929. The Anaconda Copper Mining Co. is by far the most important producer in the district. The output of the Butte district for a number of years is given in the following table.

Copper and associated metals produced in Butte district, Montana, 1921–1930

Year	Copper	Gold	Silver	Year	Copper	Gold	Silver
	Pounds		*Ounces*		*Pounds*		*Ounces*
1921	47, 958, 000	$280, 085	4, 980, 285	1926	252, 991, 000	$678, 290	11, 058, 861
1922	165, 374, 000	540, 936	10, 394, 811	1927	221, 312, 000	540, 827	9, 658, 204
1923	223, 043, 000	624, 528	11, 835, 643	1928	247, 067, 000	595, 495	9, 558, 587
1924	247, 364, 000	730, 646	11, 859, 290	1929	296, 316, 000	538, 419	9, 918, 841
1925	266, 637, 000	746, 422	11, 561, 659	1930	195, 472, 000	268, 066	5, 257, 529

The Anaconda Copper Mining Co. and its subsidiaries produced the following amounts of metals from its copper operations during 1930.

Metals produced by Anaconda Copper Mining Co. and its subsidiaries from copper operations in 1930

	Copper	Silver	Gold
	Pounds	*Ounces*	*Ounces*
Anaconda Copper Mining Co	197, 233, 145	5, 569, 147. 05	21, 209. 005
Andes Copper Mining Co	94, 045, 494	130, 632. 90	6, 629. 045
Chile Copper Co	179, 191, 243	------	------
Greene Cananea Copper Co	42, 424, 773	279, 728. 93	7, 941. 411
International Smelting Co	134, 517, 010	1, 612, 270. 99	49, 577. 007
	647, 411, 665	7, 591, 779. 87	85, 356. 468

Of the total, 146,425,362 pounds of copper, 2,509,791.35 ounces of silver, and 59,155.173 ounces of gold were produced from custom ores and ores treated on toll.

Total expenditures for construction during 1930 were $8,425,629; they were distributed as follows:

Butte mines	$399, 673. 70
Reduction works, Anaconda	58, 919. 04
Reduction works, Great Falls	169, 832. 50
American Brass Co. and subsidiaries	2, 442, 740. 51
Raritan Copper Works	21, 847. 85
International Smelting Co	67, 590. 85
International Lead Refining Co	52, 992. 17
Andes Copper Mining Co	1, 911, 627. 47
Chile Copper Co	1, 879, 418. 75
Greene Cananea Copper Co	1, 179, 536. 32
Miscellaneous	241, 449. 72

Net earnings (including those of subsidiary companies) for the year, after all charges except depletion were deducted, amounted to $18,782,968.

Copper, gold, and silver produced by Anaconda Copper Mining Co. from company ores, 1921–1930

Year	Copper ore treated	Copper	Silver	Gold	Dividends
	Short tons	*Pounds*	*Ounces*	*Ounces*	
1921	395, 239	32, 267, 345	2, 137, 062	8, 619	------
1922	1, 878, 162	141, 741, 235	6, 755, 212	25, 720	------
1923	2, 735, 534	200, 779, 688	8, 568, 607	29, 726	$9, 000, 000
1924	3, 017, 417	238, 247, 038	8, 345, 841	37, 689	2, 250, 000
1925	2, 750, 736	266, 373, 956	9, 054, 741	38, 390	9, 000, 000
1926	2, 570, 162	254, 302, 568	8, 226, 724	31, 764	9, 000, 000
1927 [1]	2, 866, 785	221, 300, 270	6, 638, 127	32, 674	9, 000, 000
1928 [1]	2, 975, 206	247, 577, 554	6, 165, 123	36, 564	14, 419, 034
1929 [2]	(3)	297, 014, 107	8, 564, 609	33, 077	53, 567, 278
1930 [2]	(3)	197, 233, 145	5, 569, 147	21, 209	34, 314, 426

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[1] Reported in 1927 and 1928 as tonnage treated in plant and production, including purchased and toll material.

[2] Includes metals from custom ores and ores treated on toll.

[3] Not given.

The Butte & Superior Mining Co. in 1930 produced 729 dry tons of copper ore, the metal content of which was as follows: Copper, 25,914 pounds (1.78 per cent); gold, 2.77 ounces; silver, 4,886 ounces; lead, 2,068 pounds; and zinc, 63,423 pounds. The company also produced 79,242 tons of zinc ore which contained 653 ounces of gold, 522,280 ounces of silver, 346,373 pounds of copper, 1,939,445 pounds of lead, and 21,000,962 pounds of zinc. At the beginning of 1930 reserves amounted to 183,048 tons of zinc ores averaging 14.77 per cent zinc and 5.55 ounces of silver, compared with 288,875 tons averaging 15.35 per cent zinc and 5.68 ounces of silver at the beginning of 1931. In addition to the reserves quoted on December 31, 1930, there were 141,405 tons of measured low-grade reserves and 150,000 tons of low-grade zinc material which were unprofitable at the time. This does not include 98,946 tons of zinc ore in the old upper level ore bodies.

The East Butte Mining Co. closed down in October, and it is reported that liquidation of all assets was under way.

NEVADA

In 1930 Nevada produced 87,475,019 pounds of copper (6.27 per cent of the total for the country) and again ranked fifth among the copper-producing States. From the beginning of operations through 1930 Nevada has produced 1,808,960,369 pounds (4 per cent of the country's total) and also ranks fifth. Most of the copper produced in Nevada comes from the Ely (Robinson) district.

Ely (Robinson) district.—The mine production in the Ely district in 1930 amounted to 105,385,000 pounds, compared with 130,755,000 pounds in 1929. Through 1930 this district has produced a total of 1,647,674,000 pounds (3.71 per cent of the country's total) and ranks eighth among the districts. The Nevada Consolidated Copper Co. produces most of the output of the district and the State.

Metals produced in Ely (Robinson) district, Nevada, 1921–1930

[Mine figures]

Year	Ore	Copper produced	Average yield in copper	Gold and silver per ton of ore
	Short tons	*Pounds*	*Per cent*	*Cents*
1921	400, 810	10, 282, 527	1. 28	25
1922	630, 871	22, 614, 736	1. 79	19
1923	2, 833, 674	65, 928, 279	1. 16	24
1924	3, 505, 362	73, 279, 064	1. 05	21
1925	3, 922, 770	78, 627, 308	1. 00	21
1926	4, 672, 240	95, 009, 115	1. 02	18
1927	4, 488, 009	107, 441, 000	1. 20	24
1928	5, 730, 471	141, 969, 000	1. 24	28
1929	6, 378, 138	130, 755, 000	1. 03	22
1930	3, 999, 077	105, 385, 000	1. 32	28

At the Nevada mines of the Nevada Consolidated Copper Co. 2,769,471 dry tons of ore were taken from the shovel pits and underground workings and delivered to the mill. This, with 1,076,005 dry tons of custom ore, brought the total ore concentrated up to 3,845,476 dry tons, an average of 10,536 tons daily; the cost of milling, exclusive of depreciation and taxes but including all other expenses, was 45.77 cents per ton. At the company's Ray mines, in Arizona, 2,327,100 dry tons of ore, or an average of 6,376 tons per day, were handled in the Hayden concentrator at a cost of 38.16 cents per ton. At the company's Chino mines, in New Mexico, a total of 2,513,560 dry tons, or an average of 6,886 tons per day, were handled, all of which went through the Hurley concentrator; the milling cost, exclusive of depreciation and taxes, was 54.53 cents per ton. The total ore milled at the three properties was 8,686,136 tons, an average of 23,798 tons per day. The average grade of all company ore handled was 1.213 per cent of copper, and the average recovery in the form of concentrates was 86.66 per cent of the total copper content. The total ore produced from the company's mines and treated during the year amounted to 7,727,388 tons, of which 7,610,131 tons, an average of 20,850 tons per day, were concentrated. A total of 117,257 tons of company crude ore was shipped to the smelters; 1,076,005 tons of contract and other custom ore were milled and 52,237 tons were smelted at the Nevada plant. The total yield of company copper was 141,980,173 pounds. The company reports an approximate ore reserve of well over 300,000,000 tons for the three mines.

Metals produced by the Nevada mines of the Nevada Consolidated Copper Co., 1921–1930

Year	Ore treated	Average assay of copper	Average extraction of copper	Refined copper produced
	Short tons	*Per cent*	*Per cent*	*Pounds*
1921	392,645	1.49	75.23	9,362,325
1922	518,523	1.60	75.19	23,762,675
1923	2,576,388	1.31	82.90	61,573,246
1924	3,418,900	1.198	87.09	70,237,050
1925	[1] 3,234,390	[1] 1.21	92.24	73,653,886
1926	[2] 4,568,272	(3)	(3)	(3)
1927	[4] 4,376,295	(3)	(3)	(3)
1928	[5] 5,605,960	(3)	(3)	(3)
1929	[6] 6,254,029	(3)	(3)	(3)
1930	[7] 3,845,476	(3)	(3)	(3)

[1] In addition, 598,114 dry tons of porphyry sulphide material, averaging 0.684 per cent copper, was concentrated, giving a recovery in electrolytic copper of 9.63 pounds to a ton milled.

[2] Includes 208,143 tons of custom ore.

[3] Not given separately. In 1926 the copper content of Ray, Nevada, and Chino production was 1.268 per cent, mill recovery 86.26 per cent, and refined copper output 231,119,539 pounds; in 1927 copper content was 1.326 per cent, mill recovery 87.92 per cent, and refined copper output 218,683,930 pounds; in 1928 copper content was 1.363 per cent, mill recovery 86.56 per cent, and refined copper output 268,462,629 pounds; in 1929 copper content was 1.257 per cent, mill recovery 84.74 per cent, and refined copper output 266,274,918 pounds; in 1930 copper content was 1.213 per cent, mill recovery 86.66 per cent, and refined copper output 141,980,173 pounds.

[4] Includes 600,502 tons of custom ore.

[5] Includes 941,942 tons of custom ore.

[6] Includes 1,033,042 tons of custom ore.

[7] Includes 1,076,005 tons of custom ore.

The Consolidated Coppermines Corporation in 1930 produced 32,612,203 pounds of copper, 13,918 ounces of gold, and 32,157 ounces of silver from 1,114,678 dry tons of ore averaging 1.64 per cent copper. A total of 24,020 feet of development work was done in 1930. Most of the tonnage came from the Emma, Alpha, and Morris-Brooks mines.

Development work in the Alpha mine has disclosed more and better ore on the 1,400 level than was found on the 1,300 level, the average content of the 1,400 level ores being 8 per cent copper. Preliminary work was done on the 1,600 and 1,800 levels. Important additions were made in the reserves of the Emma Nevada mine by churn drilling. On January 1, 1931, the developed concentrating ore was in excess of 35,000,000 tons, having an average grade, as mined, of 1.10 per cent copper (all properties).

NEW MEXICO

From the beginning of operations to the end of 1930 New Mexico has produced 1,387,204,492 pounds of copper (3.12 per cent of the country's total output of 44,448,876,489 pounds) and ranks sixth among the producing States. New Mexico ranked sixth also in production in 1930, with an output of 74,187,966 pounds (5.32 per cent of the country's total). The Santa Rita district produces most of the copper from New Mexico, and the Chino mines of the Nevada Consolidated Copper Co. furnish most of the district production.

Central (including Santa Rita) district.—The Central district, with a production of 1,212,320,000 pounds from the beginning of operations through 1930, ranks ninth among the copper-producing districts. The production for several years is shown in the following table.

Copper produced in Central (including Santa Rita) district, New Mexico, 1921–1930, in pounds

[Mine figures]

1921	9, 138, 000	1926	75, 219, 000
1922	28, 408, 000	1927	66, 971, 000
1923	54, 375, 000	1928	80, 239, 000
1924	66, 824, 000	1929	87, 446, 000
1925	68, 812, 000	1930	57, 243, 000

The Chino branch of the Nevada Consolidated Copper Co. concentrated 2,513,560 dry tons of ore in 1930, a daily average of 6,886 tons. The cost of milling, exclusive of taxes and depreciation, was 54.53 cents per ton. Development work during 1930 practically doubled the reserves of shovel ore, rendering it unnecessary to continue underground development on the Ray plan at present. The cost of open-pit mining was 33.40 cents per ton, and stripping operations cost 45 cents per ton. The improvements at the Hurley concentrator, begun in 1928, were completed in 1930.

Metals produced by the Chino mines of the Nevada Consolidated Copper Co., New Mexico, 1921–1930

Year	Ore milled	Copper content	Mill recovery	Refined copper produced
	Short tons	*Per cent*	*Per cent*	*Pounds*
1921	361, 660	1. 70	77. 36	9, 137, 282
1922	1, 416, 869	1. 55	66. 99	28, 406, 314
1923	2, 785, 564	1. 50	66. 34	54, 261, 228
1924	2, 706, 200	1. 59	77. 83	66, 574, 486
1925	3, 002, 700	1. 42	80. 54	67, 385, 620
1926	3, 523, 319	(1)	(1)	(1)
1927	2, 982, 137	(1)	(1)	(1)
1928	3, 596, 144	(1)	(1)	(1)
1929	3, 973, 300	(1)	(1)	(1)
1930	2, 513, 560	(1)	(1)	(1)

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[1] Not given separately. In 1926 the copper content of Ray, Nevada, and Chino production was 1.268 per cent, mill recovery 86.26 per cent, and refined copper output 231,119,539 pounds; in 1927 copper content was 1.326 per cent, mill recovery 87.92 per cent, and refined copper output 218,683,930 pounds; in 1928 copper content was 1.363 per cent, mill recovery 86.56 per cent, and refined copper output 268,462,629 pounds; in 1929 copper content was 1.257 per cent, mill recovery 84.74 per cent, and refined copper output 266,274,918 pounds; in 1930 copper content was 1.213 per cent, mill recovery 86.66 per cent, and refined copper output 141,980,173 pounds.

Lordsburg district.—The Eighty-Five mines of the Calumet & Arizona Mining Co. produced 80,561 wet tons of ore in 1930, averaging 2.74 per cent copper. A total of 9,335 feet of development work was completed, compared with 5,909 feet completed in 1929. The Jim Crow mine was sunk 625.5 feet to a depth of 1,743 feet. The production of the Lordsburg district during several years has been as follows:

Copper produced in Lordsburg district, New Mexico, 1921–1930, in pounds

[Mine figures]

1921	579, 000	1926	4, 763, 000
1922	3, 217, 000	1927	3, 933, 000
1923	4, 314, 000	1928	4, 625, 000
1924	4, 928, 000	1929	4, 248, 000
1925	5, 064, 000	1930	4, 857, 000

TENNESSEE

For 1929 and 1930 the Bureau of Mines is not at liberty to publish the production of Tennessee because of objections by the companies concerned; in 1928 Tennessee produced 16,374,261 pounds of blister copper (0.9 per cent of the country's total) and ranked ninth among the copper-producing States. From the beginning of operations through 1928 Tennessee also ranked ninth, having produced approximately 519,017,000 pounds of copper (1.26 per cent of the total output of the country). The entire output comes from the Ducktown district, in Polk County, in the extreme southeastern part of the State.

Copper produced in Ducktown district, Tennessee, 1921–1930

Year	Copper ore treated	Copper produced (smelter)	Average yield of copper	Gold and silver per ton of ore
	Short tons	*Pounds*	*Per cent*	*Cents*
1921	564, 457	15, 084, 294	1. 34	18
1922	557, 750	14, 226, 232	1. 28	15
1923	776. 477	18, 721, 932	1. 21	12
1924	714, 975	18, 251, 996	1. 28	10
1925	794, 930	19, 789, 234	1. 24	10
1926	608, 040	18. 601, 586	1. 53	12
1927	630. 955	14, 498, 951	1. 18	9
1928	759, 995	16, 374, 261	1. 08	7
1929	(1)	(1)	(1)	(1)
1930	(1)	(1)	(1)	(1)

[1] Bureau of Mines not at liberty to publish figures.

In 1930 the Tennessee Copper Co. operated on a reduced scale and produced less than the high record attained in 1929. The combined operating profit reported by the Tennessee Corporation and its subsidiaries was $2,070,730; and the net profit, after depreciation, bond interest, and reserves were deducted, was $1,034,907, a drop from the profit in the previous year. The company operated the Burra-Burra and Eureka mines throughout 1930. The Polk County mine development work is giving encouraging results. Ore reserves on January 1, 1931, were estimated at 6,034,148 tons, an increase of 254,589 tons over the figure on January 1, 1930.

Copper and sulphuric acid produced by Tennessee Copper Co., 1921–1930

Year	Ore treated	Copper	Sulphuric acid, 60° B.	Year	Ore treated	Copper	Sulphuric acid, 60° B.
	Short tons	*Pounds*	*Short tons*		*Short tons*	*Pounds*	*Short tons*
1921	302,584	8,081,322	242,743	1926	506,527	12,566,665	354,722
1922	287,499	7,553,281	218,676	1927	420,255	11,063,234	291,393
1923	484,524	12,013,988	290,231	1928	(1)	13,585,856	(1)
1924	451,777	12,726,635	247,477	1929	(1)	(1)	(1)
1925	516,964	13,625,707	329,395	1930	(1)	(1)	(1)

[1] Not given. The production of copper and sulphuric acid in 1929 was reported by the company to be the largest in its history and in 1930 was reported to be on a reduced scale.

UTAH

The smelter production of copper in Utah decreased from 325,965,289 pounds in 1929 to 205,769,698 pounds in 1930. The 1930 production represented 14.76 per cent of the total United States output, and Utah again ranked second among the copper-producing States. From the beginning of operations through 1930 Utah has produced a total of 4,555,074,357 pounds of copper (10.25 per cent of the total for the country) and ranks fourth among the copper-producing States. Utah, like most of the other copper-producing States, has one outstanding district—the Bingham.

Bingham district.—The Bingham district ranked second among the copper-producing districts of the country in 1930. In total production from the beginning of operations through 1930 this district ranks third, with an output of 4,110,224,000 pounds. The main producer of the district is the Utah Copper Co.

Copper produced in Bingham district, Utah, 1921–1930, in pounds

[Mine figures]

1921	28,011,000	1926	248,975,000
1922	91,762,000	1927	249,919,000
1923	216,037,000	1928	287,685,000
1924	236,181,000	1929	311,892,000
1925	227,612,000	1930	175,070,000

The Utah Copper Co. in 1930 produced and shipped to the mills 9,552,500 dry tons of ore, a daily average of 26,315 tons, all of which the company milled. The ore averaged 0.973 per cent copper (19.46 pounds per ton). The average recovery in the form of concentrates was 89 per cent (17.32 pounds per ton), compared with 85.67 per cent (17.04 pounds per ton) in 1929. The mills operated 363 days at an average daily rate of 26,315 tons. The average milling cost was 46.09 cents per ton, compared with 36.58 cents in 1929, an increase in cost of 9.51 cents per ton. The concentrates shipped to the smelter averaged 32.25 per cent and contained 165,444,216 gross pounds of copper, compared with concentrates averaging 32.06 per cent of copper and containing 302,013,015 pounds in 1929. Precipitates derived from mine waters and waste-dump waters contained 1,078,739 pounds of copper and brought the production from all sources to 166,522,955 pounds, compared with 306,527,513 pounds in 1929. The net production of refined copper in 1930 was 161,138,717 pounds. The cost of all operations, as usually figured, was 8.47 cents per pound, compared with 6.65 cents per pound in 1929. A total of 203,421,177 tons of copper ores of all classes has been mined to date, and the total ore reserves on December 31, 1930, amounted to about 640,000,000 tons, averaging 1.07 per cent copper. This indicates that there will have been mined in all, not allowing for new developments, more than 843,000,000 tons when the present reserves are exhausted.

Metals produced by Utah Copper Co. from ore milled, 1921–1930

Year	Ore milled	Copper content	Mill recovery	Copper [1]	Gold, silver, and miscellaneous income per pound of copper	Dividends (includes capital distribution)
	Short tons	*Per cent*	*Per cent*	*Pounds*	*Cents*	
1921	1,220,700	1.16	83.87	24,511,593	1.15	$4,061,225
1922	4,364,251	1.26	80.00	84,777,712	1.45	3,248,980
1923	11,167,800	1.12	80.96	195,142,919	1.313	6,497,960
1924	12,126,600	1.07	85.94	214,592,733	1.206	6,497,960
1925	12,538,300	1.02	86.96	214,162,139	1.36	6,904,083
1926	13,880,100	1.01	87.01	234,173,625	1.36	8,528,572
1927	13,811,500	.979	89.12	233,002,661	1.16	9,746,940
1928	16,558,500	.992	85.56	273,823,351	1.22	12,995,920
1929	17,724,100	.994	85.67	296,625,554	1.45	32,489,800
1930	9,552,500	.973	89.00	161,138,717	1.23	16,244,900

[1] Net production of refined copper, not copper content of concentrates.

Cost of mining, milling, and concentrating copper ore by Utah Copper Co., 1921–1930

Year	Ore (short tons)	Cost per ton			
		Mining	Transportation	Milling	Total
1921	1,220,700	$0.4998	$0.1921	$1.1679	$1.8598
1922	4,364,251	.3833	.1612	.8417	1.3862
1923	11,167,800	.3488	.1088	.6116	1.0692
1924	12,126,600	.3605	.1308	.5990	1.0903
1925	12,538,300	.3373	.1151	.5382	.9906
1926	13,880,100	.3139	.1019	.4843	.9001
1927	13,811,500	.3734	.0926	.4523	.9183
1928	16,558,500	.3178	.0874	.3690	.7742
1929	17,724,100	.4121	.0896	.3658	.8675
1930	9,552,500	.5043	.1042	.4609	1.0694

The Ohio Copper Co. produced 2,048,369 pounds of copper in 1930, compared with 2,215,178 pounds in 1929. The cost per pound of refined copper declined from 14.0613 cents in 1929 to 13.2641 cents in 1930. A survey was made during 1928 of the tailings dump; its estimated contents were calculated as 4,995,459 tons containing 0.475 per cent copper (47,405,671 pounds). Experimental work indicated that this ore can be treated profitably and that 80 per cent of the soluble copper in the outer portion of the dump can be extracted at a cost of about 16 cents per ton, or 5 cents per pound of recoverable copper. By using flotation on material deeper in the tailings pile, it is estimated that 6 pounds of copper can be recovered in addition, at a cost of about 6 cents per pound. During the year 3,309 feet of development work were completed. About 1,300 tons of copper-bearing material was removed from development work and shipped. This ore averaged about $4 per ton in gold, 1.72 ounces of silver, and 1.92 per cent copper.

Copper production of the Ohio Copper Co., of Utah, in 1930

	Copper produced	Cost per pound	Price per pound	Profit per pound	Operating profits
	Pounds	*Cents*	*Cents*	*Cents*	
First quarter	518, 336	14. 4878	17. 7125	3. 2247	$16, 952. 68
Second quarter	498, 805	13. 8243	13. 3783	[1] . 4460	[2] 2, 224. 64
Third quarter	540, 598	11. 5799	10. 6217	[1] . 9582	[2] 5, 179. 79
Fourth quarter	490, 630	12. 3332	10. 0088	[1] 2. 3244	[2] 11, 404. 39
	2, 048, 369	13. 2641	12. 9503	[1] . 0906	[2] [3] 1, 856. 14

[1] Loss per pound.

[2] Operating loss.

[3] After adding miscellaneous income and deducting interest on bonds, taxes, and other miscellaneous charges the net loss was $52,723.65. After allowances for depreciation and depletion, a loss of $117,904.92 was deducted from surplus.

Tintic district.—The Tintic district produced 2,862,000 pounds of copper in 1930, compared with 3,166,000 pounds in 1929. From the beginning of operations through 1930 the district has yielded 184,874,000 pounds of copper. The production for several years is as follows:

Copper produced in Tintic district, Utah, 1921–1930, in pounds

[Mine figures]

1921	1, 570, 000	1926	5, 226, 000
1922	2, 295, 000	1927	3, 783, 000
1923	3, 033, 000	1928	2, 457, 000
1924	3, 076, 000	1929	3, 166, 000
1925	4, 627, 000	1930	2, 862, 000

REFINERY PRODUCTION

The refinery output of copper in the United States in 1930 was made by 12 plants; 8 of these employed the electrolytic method, 3 employed the furnace process on Lake Superior copper, and 1 the furnace process on Arizona ore.

Five of the large electrolytic refineries are on the Atlantic seaboard, the 3 Lake refineries are on the Great Lakes, and 4 plants are west of the Great Lakes—1 at Great Falls, Mont., 1 at Tacoma, Wash., 1 at El Paso, Tex., and 1 at Clifton, Ariz. In addition to these refineries are the electrolytic plants at Ajo and Inspiration, Ariz., which make electrolytically refined copper directly from the liquors obtained from leaching operations; this copper is shipped as cathodes to eastern refineries, where it is melted and cast into merchant shapes, and is accounted for in the production reported from these eastern refineries. There are also numerous plants in different parts of the country that make a considerable output from old copper and from brass and other alloys of copper. The output of the regular refining plants is in the form of casting, Lake, and electrolytic copper.

Refinery production from ores of domestic and foreign origin is shown in the table on page 740. The domestic figure is the one that is to be compared with smelter production from domestic sources, the main difference being the time factor explained on page 701 of this report; the figures for refinery production include copper that was mined some three months earlier than the beginning of the calendar year and smelted probably one or two months earlier.

CASTING AND PIG COPPER

Blister copper that is low in precious metals and free enough from impurities for certain uses is refined by the furnace process and ordinarily cast into ingots. This copper is usually unfit for uses requiring a high-grade copper, such as electric transmission, brass manufacture, and rolling, but is suitable for copper castings, and a large part of it is put to that use. Lake copper excepted, a comparatively small percentage of the copper output carries so small a content of precious metals that, together with the added value of electrolytic copper, it will not more than pay for the electrolytic refining of the copper; consequently, the output of casting copper is small. Some blister or pig copper low in precious metals has been exported without further treatment and is probably consumed without electrolytic refining. Some of the districts produced a rather high grade of blister copper carrying a small amount of precious metals, and it is found profitable to market some of this copper without electrolytic refining. During 1930 the production of furnace-refined new casting copper from domestic and foreign sources amounted to 20,467,886 pounds. No unrefined pig and best select copper was reported as produced in 1930.

LAKE COPPER

Lake copper, as the term is used in this report, means the output of the Lake smelters. Formerly a considerable proportion of this output was refined electrolytically. Most of the electrolytically refined Lake copper is mixed with furnace-refined copper or is sold as some brand of Lake copper. Since December, 1922, the electrolytic plant of the Calumet & Hecla Consolidated Copper Co. has not been in commission because the silver content of the copper was not sufficient to pay for its recovery. The production of Lake copper in 1930 amounted to 142,985,522 pounds.

ELECTROLYTIC COPPER

In 1930 the approximate production of electrolytic copper from primary materials of domestic origin amounted to 1,228,416,733 pounds and from materials of foreign origin to 765,189,037 pounds; and, in addition, production from secondary sources amounted to 279,423,370 pounds—a total electolytic production of 2,273,029,140 pounds for 1930, compared with 2,874,167,844 pounds for 1929.

REFINED COPPER

The total output of new refined copper in 1930 was 2,157,059,178 pounds, a decrease of 583,053,198 pounds from that in 1929. Adding to the new refined copper produced from domestic and foreign sources the imports of refined copper gives the new copper made available for consumption during the year. In the following table is shown also the production of secondary copper by the regular refineries, but not the output of plants that treat only secondary material; the latter is shown in the table on page 740.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1925-1930, in pounds

	1925	1926	1927	1928	1929	1930
Primary:						
Domestic[1]—						
Electrolytic	1,533,995,439	1,553,041,424	1,520,076,181	1,607,120,026	1,785,754,654	1,228,416,733
Lake	138,029,764	172,372,304	195,135,199	179,104,311	185,300,917	142,985,522
Casting	10,870,144	5,883,433	3,740,819	5,573,050	11,676,718	19,821,950
	1,682,895,347	1,731,297,161	1,718,952,199	1,791,797,387	1,982,732,289	1,391,224,205
Foreign[1]—						
Electrolytic	516,632,530	588,932,788	605,748,329	693,787,036	756,555,087	765,189,037
Casting and best select	5,045,947	2,255,427	1,063,181	2,023,356	825,000	645,936
Refinery production, new copper	2,204,573,824	2,322,485,376	2,325,763,709	2,487,607,779	2,740,112,376	2,157,059,178
Imports refined copper	99,773,546	170,565,766	103,279,082	84,730,630	134,014,792	86,210,331
Total new refined copper made available	2,304,347,370	2,493,051,142	2,429,042,791	2,572,338,409	2,874,127,168	2,243,269,509
Secondary:						
Electrolytic	140,349,541	163,061,465	168,766,566	191,323,029	331,858,103	279,423,370
Casting	58,010,653	62,056,941	41,102,000	41,322,776	2,300,000	1,106,114
	198,360,194	225,118,406	209,868,566	232,645,805	334,158,103	280,529,484
Grand total	2,502,707,564	2,718,169,548	2,638,911,357	2,804,984,214	3,208,285,271	2,523,798,993

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

If the output of plants treating only secondary material is added to the production of the regular refining companies, the contribution from plants in the United States to the world's supply of copper for 1930 is found to be 3,091,000,000 pounds.

SECONDARY COPPER

Under secondary copper is considered material recovered from remelting old copper, copper scraps, and copper recovered from the treatment of copper alloys or alloys that are treated without the separation of the copper. A canvass of plants producing secondary copper has been made by J. P. Dunlop, of the Bureau of Mines, and the following figures are taken from his report on Secondary Metals in Mineral Resources.

Secondary copper recovered in the United States in 1930 and imports and exports of scrap brass and copper, in short tons

Copper as metal	244,800
Copper in alloys other than brass	88,000
	332,800
Copper from new scrap (not including brass)	62,700
Copper from old scrap (not including brass)	270,100
	332,800
Brass scrap remelted:	
New clean scrap	89,000
Old scrap	103,000
	192,000

Copper content of brass scrap (averaging about 70 per cent copper):	
New clean scrap	62, 300
Old scrap	72, 100
	134, 400
Total copper produced from secondary sources (including copper content of brass scrap):	
From new scrap	125, 000
From old scrap	342, 200
	467, 200
Imports of scrap brass	3, 573
Imports of scrap copper	3, 750
Exports of scrap brass	22, 613
Exports of scrap copper	16, 943

Refined copper from secondary sources produced in the United States, 1921–1930, in pounds

1921	434, 600, 000	1926	959, 600, 000
1922	671, 800, 000	1927	980, 400, 000
1923	821, 800, 000	1928	1, 072, 800, 000
1924	776, 600, 000	1929	1, 253, 100, 000
1925	840, 420, 000	1930	934, 400, 000

COPPER SULPHATE

The production of hydrous copper sulphate or bluestone by the copper refineries of the United States in 1930 was 36,976,403 pounds, having a copper content of 9,419,000 pounds, compared with 40,258,860 pounds, having a copper content of 10,255,000 pounds, in 1929.

STOCKS

Stocks of copper in the United States, January 1, 1922–1931, in pounds

Year	Refined copper	Blister and materials in process of refining	Year	Refined copper	Blister and materials in process of refining
1922	459, 000, 000	283, 000, 000	1927	146, 000, 000	455, 000, 000
1923	216, 000, 000	361, 000, 000	1928	171, 000, 000	401, 000, 000
1924	264, 000, 000	432, 000. 000	1929	114, 000, 000	423, 000, 000
1925	243, 000, 000	393, 000, 000	1930	306, 000, 000	500, 000, 000
1926	124, 000, 000	432, 000, 000	1931	615, 000, 000	450, 000, 000

IMPORTS AND EXPORTS

The imports of unmanufactured copper in 1930 amounted to 817,154,236 pounds, a decrease of 157,157,965 pounds from the record imports of unmanufactured copper in 1929. Large quantities of unrefined copper were imported from the Belgian Congo, as well as from Canada, Chile, Mexico, and Peru, for refining in the United States, and large quantities of ores and concentrates were received from Canada, Chile, Cuba, Mexico, and Spain. The only refined copper imported was from Chile and Canada. Virtually all the ore and blister produced in Chile but not refined there is sent to the United States for treatment.

Copper (unmanufactured) imported into the United States, 1929 and 1930, in pounds

[General imports]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper fit only for remanufacture, and scale and clippings	Composition metal, copper chief value
1929							
Africa:							
Belgian Congo	263,720			55,091,068			
British—Union of South	30,805	179,999					
Mozambique	931	2,900	52,924	7,803,865			
Australia	186,762						
Canada	54,844,182	5,833,620	217,780	132,519,194	679,315	11,394,168	5,002
Chile	40,534,646	1,071,394		164,265,111	133,082,539	14,812	
Cuba	339,713	9,810,270				1,091,152	
France	1,185,755	1,111,870		3,717,719	20,616	49,625	
Germany	1,653,882	1,418,540	105,665	7,114,367	232,322	151,644	74,214
Mexico	1,447,954	29,909,338	890,490	138,174,222		148,426	
Peru	7,005,284	50,594	74,096	117,772,651		27,509	
Spain	14,633,315			2,246,767			
United Kingdom	1,019,777	9,903		14,435,473		10,280	560
Venezuela						91,696	
Other	1,472,286	4,330,397	763,500	3,026,618		618,854	120
	124,619,012	53,728,825	2,104,455	646,167,055	134,014,792	13,598,166	79,896
Total value	$15,358,271	$7,907,180	$292,316	$104,306,141	$23,757,421	$1,823,464	$12,064
1930							
Africa:							
Belgian Congo	397,090			72,061,317			
British—Union of South	5,221	217,258		14,980			
Mozambique	31,078	92,562					
Australia	80,246	503,834	64,426	3,466,138			
Canada	48,796,081	7,473,652	10,500	149,323,370	6,266,188	5,793,587	7,653
Chile	29,526,290	58,413	270,332	78,836,782	79,944,143		
Cuba	5,953,778	20,056,670				633,380	
France	968,372	368,248	212,607	1,747,129		50,237	
Germany	1,104,915	624,009	1,390,288	5,067,395		232,348	22,160
Japan				14,476,145		195	
Mexico	1,524,758	24,691,583	645,483	118,381,569		79,140	
Peru	1,109,793	330,907	33,442	110,679,197			
Spain	9,681,185	41,751	1,624,763	410,262			
United Kingdom	77,638	103,632	327,441	3,270,039		21,106	672
Venezuela						73,736	
Other	2,060,110	2,308,370	127,100	2,734,824		615,271	51,447
	101,316,555	56,870,889	4,706,382	560,469,147	86,210,331	7,499,000	81,932
Total value	$11,395,290	$5,980,059	$536,429	$74,247,901	$11,374,184	$835,838	$7,929

Copper (unmanufactured) imported into the United States, 1921–1930, in pounds

[General imports]

1921	350,472,611	1926	779,441,803
1922	541,013,220	1927	718,322,990
1923	676,473,338	1928	787,073,640
1924	768,813,731	1929	974,312,201
1925	652,971 407	1930	817,154,236

According to the Bureau of Foreign and Domestic Commerce, as shown in the following table, 179,095 pounds of copper in "ore, concentrates, composition metal, and unrefined copper" were exported in 1930. In that year, as in 1929, the copper producers reported that much more than this amount of blister was exported. It develops that about 15 times the quantity of blister copper recorded as exported in 1930, and considerably more than twice that recorded for 1929, was exported but was incorrectly classified as "refined copper" in the compilation of customs statistics.

In 1930 the United States exported more copper to the United Kingdom than to any other country; France stood second in order of importance and Germany third. In 1929 United Kingdom was first, Germany second, and France third. The exports (in millions of pounds) from the United States to the six leading importers of United States copper in 1930 were as follows: United Kingdom 176, France 148, Germany 110, Italy 81, Canada 44, and Netherlands 40, compared with exports to the six leading importers in 1929 as follows: United Kingdom 217, Germany 200, France 181, Italy 88, Canada 76, and Belgium 49.

Copper exported from the United States, 1929 and 1930, in pounds

Country	Ore, concentrates, composition metal, and unrefined copper (copper content) [1]	Refined [1]		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
1929									
Belgium		45,749,962	2,533,960	614,347			1,360	35,455	(2)
Canada	597,049	38,691,880	22,171,079	4,462,840	2,569,479	3,107,052	1,739,064	3,042,952	
China		5,604,022		54,480	5,613	18,006	596,815	384,296	
Denmark		1,776,102	336,208			3,528	18,543	33,839	
France		175,264,821	2,500,331	2,654,547	617		48,686	132,179	
Germany	375,550	178,879,194	72,372	19,189,236	243	672,451	609,875	12,358	
India (British)		4,043,059	90,513	157,290	31,569	14,281	353,961	450,979	
Italy		84,491,310	313,944	279,512		651,664	681,485	1,231,826	
Japan		7,953,500	46,601	4,128,957	3,022	3,475	186,561	178,484	
Netherlands	33,997	32,534,775	5,436,278	2,960,086	6,881	112,497	60,901	103,191	
Norway		1,366,156	2,573,618	26,400	5,351		16,038	21,846	
Spain		2,252,963		1,073,444	5,731		60,029	53,148	
Sweden		32,495,033	504,674	12,503			225,500	8,308	
Switzerland		336,398					1,382	4,358	
United Kingdom	4,536,574	175,449,512	31,713,323	1,958,092	12,888	870,509	1,049,690	1,499,122	
Other	36,260	35,565,237	12,794,928	63,755	804,670	869,256	11,218,746	17,888,127	
	5,579,430	822,453,924	81,087,829	37,635,489	3,446,074	6,322,719	16,868,636	25,080,448	(2)
Total value	$935,604	$148,435,789	$14,584,737	$5,675,750	$967,462	$1,576,383	$3,332,229	$6,176,455	$1,720,363
1930									
Belgium		26,364,532	8,106,815	1,075,238		67,211	251	90,049	(2)
Canada	112,377	13,764,603	21,625,069	1,341,203	1,824,655	2,761,757	464,432	2,263,230	
China		5,626,532	4,242	26,660	94	8,675	187,620	276,672	
Denmark		2,099,582	1,008,211		388	644	33,432	19,157	
France		141,237,293	1,951,292	4,578,216	1,276	200,336	44,333	141,445	
Germany		93,860,008		14,288,455	4,561	829,582	739,712	4,779	
India (British)		2,680,595	939,375	576,410	59	3,019,956	559,302	180,332	
Italy		78,707,287		106,127		1,827,332	36,228	23,048	
Japan	1,132	3,187,112	27,314	1,756,257	1,210	6,384	15,434	116,977	
Netherlands	1,976	27,146,308	5,928,285	5,648,314		583,679	204,269	42,203	
Norway		1,729,632	2,834,119				3,378	17,054	
Russia in Europe		12,695,138					1,963,393	49,226	
Spain		258,487		2,167,672	13,985		68,072	154,237	
Sweden		30,673,059				55,920	15,430	452,115	
United Kingdom		142,789,077	27,460,545	2,219,607	7,909	1,027,423	924,449	1,136,091	
Other	63,610	11,295,748	5,252,547	101,481	843,260	594,470	10,490,690	15,578,704	
	179,095	594,114,993	75,137,814	33,885,640	2,697,397	10,983,369	15,750,425	20,545,289	(2)
Total value	$18,569	$79,691,216	$10,958,235	$3,744,311	$673,667	$1,876,248	$2,714,352	$4,639,577	$1,025,875

[1] See text on preceding page.

[2] Figures for quantity not recorded.

Copper exported from the United States, 1921–1930

Year	Pounds		Total value	Year	Pounds		Total value
	Metallic[1]	Total			Metallic[1]	Total	
1921	628,415,714	628,804,750	$85,351,928	1926[2]	960,220,112	965,685,264	$139,853,365
1922	742,755,957	743,039,888	103,874,007	1927[2]	1,069,493,121	1,076,729,246	149,114,730
1923	828,854,827	829,314,002	129,219,975	1928[2]	1,121,186,640	1,125,019,417	168,525,383
1924	1,116,775,136	1,116,915,484	156,645,684	1929[2]	992,895,119	998,474,549	181,684,409
1925	1,082,369,439	1,084,208,532	161,165,820	1930[2]	753,114,927	753,294,022	104,316,175

[1] Exclusive of ore, concentrates, and composition metal, and in 1923–1930 of unrefined copper, figures for which are not separable from those for ore and concentrates.

[2] Exclusive of "Other copper manufactures," valued at $1,350,391 in 1926, $1,098,886 in 1927, $1,296,996 in 1928, $1,720,363 in 1929, and $1,025,875 in 1930; quantity not recorded.

Copper sulphate (blue vitriol) exported from the United States, 1921–1930

Year	Pounds	Value	Year	Pounds	Value
1921	3,582,933	$217,491	1926	4,798,620	$231,175
1922	5,250,556	256,432	1927	6,206,904	320,653
1923	2,290,905	130,213	1928	8,666,899	455,023
1924	2,988,039	142,626	1929	6,419,688	368,481
1925	6,139,344	285,870	1930	5,061,554	252,614

Brass and bronze exported from the United States, 1929 and 1930

	1929		1930	
	Pounds	Value	Pounds	Value
Ingots	1,757,204	$267,639	2,007,597	$266,050
Scrap and old	53,734,133	5,899,399	45,226,200	4,157,101
Bars and rods	3,573,820	756,159	3,151,342	620,858
Plates and sheets	2,296,693	573,960	1,416,513	343,650
Pipes and tubes	5,294,869	1,416,014	4,634,490	1,058,923
Pipe fittings and valves	4,591,222	2,466,041	3,200,872	1,850,080
Plumber's brass goods	1,077,489	636,058	984,090	574,608
Wire of brass or bronze	1,557,899	544,541	1,341,546	427,559
Brass wood screws	(1)	169,461	(1)	125,827
Hinges and butts of brass or bronze	(1)	94,169	(1)	93,106
Other hardware of brass or bronze	(1)	881,082	(1)	588,200
Other brass and bronze manufactures	(1)	3,798,554	(1)	2,890,425
		17,503,077		12,996,387

(1) Weight not recorded.

Unmanufactured brass exported from the United States, 1921–1930

[Ingots,[1] bars, rods, plates, and sheets]

Year	Pounds	Value	Year	Pounds	Value
1921	2,874,762	$741,110	1926[1]	4,754,827	$884,907
1922	3,660,340	635,449	1927[1]	3,511,299	648,853
1923	3,465,739	703,503	1928[1]	4,403,726	905,430
1924	4,529,257	740,993	1929	7,627,717	1,597,758
1925[1]	7,975,053	1,359,594	1930	6,575,452	1,230,558

[1] Exclusive of ingots in 1925–1928, figures for which are not separable from those for "scrap and old."

CONSUMPTION

As calculated by the method shown in the following table, the quantity of new copper consumed in a year is actually the amount of new copper withdrawn from available supply on domestic account. This method of computation is not accurate, as figures on consumers' stocks are not available and can not be taken into account. In addition, much copper withdrawn on domestic account is later exported in manufactured forms. The domestic withdrawals in 1930 totaled 1,265,016,702 pounds, a decrease of 513,568,713 pounds from 1929, the record year.

New refined copper withdrawn from total year's supply on domestic account, 1923–1930, in pounds

	1923	1924	1925	1926
Total supply of new copper	2, 140, 546, 843	2, 405, 985, 978	2, 304, 347, 370	2, 493, 051, 142
Stock at beginning of year	216, 000, 000	264, 000, 000	243, 000, 000	124, 000, 000
Total available supply	2, 356, 546, 843	2, 669, 985, 978	2, 547, 347, 370	2, 617, 051, 142
Copper exported [1]	792, 073, 512	1, 072, 243, 414	1, 022, 335, 279	900, 914, 935
Stock at end of year	264, 000, 000	243, 000, 000	124, 000, 000	146, 000, 000
	1, 056, 073, 512	1, 315, 243, 414	1, 146, 335, 279	1, 046, 914, 935
Withdrawn on domestic account	1, 300, 473, 331	1, 354, 742, 564	1, 401, 012, 091	1, 570, 136, 207

	1927	1928	1929	1930
Total supply of new copper	2, 429, 042, 791	2, 572, 338, 409	2, 874, 127, 168	2, 243, 269, 509
Stock at beginning of year	146, 000, 000	171, 000, 000	114, 000, 000	306, 000, 000
Total available supply	2, 575, 042, 791	2, 743, 338, 409	2, 988, 127, 168	2, 549, 269, 509
Copper exported [1]	981, 083, 572	1, 020, 799, 531	903, 541, 753	669, 252, 807
Stock at end of year	171, 000, 000	114, 000, 000	306, 000, 000	615, 000, 000
	1, 152, 083, 572	1, 134, 799, 531	1, 209, 541, 753	1, 284, 252, 807
Withdrawn on domestic account	1, 422, 959, 219	1, 608, 538, 878	1, 778, 585, 415	1, 265, 016, 702

[1] Includes refined copper in ingots, bars, rods, or other forms.

Adding the 934,400,000 pounds of secondary copper and copper in alloys produced during the year to the 1,265,000,000 pounds of new refined copper withdrawn on domestic account gives a total of about 2,199,400,000 pounds of new and old copper that was available for domestic consumption.

USES

No official data are available showing the quantity of copper that entered the different industries.

The following table shows the copper cast in different forms in 1930. It will be noted that the total is not the same as the production of refined copper.

Copper cast in different forms in the United States in 1930

Form	Pounds	Per cent
Wire bars	1,711,000,000	70.18
Cakes	267,000,000	10.95
Cathodes	176,000,000	7.22
Ingots	177,000,000	7.26
Other forms	107,000,000	4.39
	2,438,000,000	100.00

PRICES

Reports to the Bureau of Mines from copper-selling agencies in the United States indicate that 2,477,540,000 pounds of copper was delivered to domestic and foreign purchasers in 1930 at an average price of 13 cents per pound, or 4.6 cents per pound less than the average price obtained in 1929. The average price for copper in 1930 is well below the average for the 20-year period ended in 1930.

Price per pound of copper, 1900–1930, in cents [6]

1900	16.6	1908	13.2	1916	24.6	1924	13.1
1901	16.7	1909	13.0	1917	27.3	1925	14.2
1902	12.2	1910	12.7	1918	24.7	1926	14.0
1903	13.7	1911	12.5	1919	18.6	1927	13.1
1904	12.8	1912	16.5	1920	18.4	1928	14.4
1905	15.6	1913	15.5	1921	12.9	1929	17.6
1906	19.3	1914	13.3	1922	13.5	1930	13.0
1907	20.0	1915	17.5	1923	14.7		

Average monthly prices at New York per pound of electrolytic copper, 1923–1930, in cents, as reported by the American Metal Market Co.

[F. o. b. refinery through August, 1927; thereafter, averages represent New York refinery equivalent]

Month	1923	1924	1925	1926	1927	1928	1929	1930
January	14.66	12.59	14.79	13.94	13.12	13.96	16.72	17.87
February	15.50	12.85	14.54	14.14	12.80	13.97	17.92	17.87
March	16.96	13.65	14.17	13.98	13.21	13.98	21.26	17.87
April	16.81	13.36	13.45	13.81	12.93	14.10	19.80	15.74
May	15.63	12.93	13.50	13.77	12.74	14.31	17.87	12.83
June	14.88	12.49	13.47	13.79	12.46	14.62	17.87	12.24
July	14.59	12.57	14.07	14.00	12.63	14.62	17.87	11.15
August	14.05	13.31	14.57	14.26	13.11	14.62	17.87	10.79
September	13.60	13.08	14.46	14.19	13.05	14.83	17.91	10.45
October	12.81	13.04	14.42	14.10	13.12	15.31	17.87	9.70
November	12.89	13.70	14.48	13.79	13.45	15.90	17.87	10.25
December	12.98	14.32	13.96	13.44	13.95	15.94	17.87	10.49
Average	14.61	13.16	14.16	13.93	13.05	14.68	18.23	13.11

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[6] Weed, W. H., Copper Handbook: Vol. 11, pp. 1339, 1343, for years 1900 to 1903. U. S. Geological Survey computations for electrolytic copper since 1904. For 1916 and later years, average price all marketable grades.

Average monthly quoted prices at New York per pound of electrolytic copper, 1923–1930, in cents, as reported by the Engineering and Mining Journal

Month	1923	1924	1925	1926	1927	1928	1929	1930
January	14.510	12.401	14.709	13.822	12.990	13.854	16.603	17.775
February	15.355	12.708	14.463	13.909	12.682	13.823	17.727	17.775
March	16.832	13.515	14.004	13.859	13.079	13.845	21.257	17.775
April	16.663	13.206	13.252	13.706	12.808	13.986	19.500	15.621
May	15.440	12.772	13.347	13.599	12.621	14.203	17.775	12.756
June	14.663	12.327	13.399	13.656	12.370	14.527	17.775	12.049
July	14.321	12.390	13.946	13.924	12.532	14.527	17.775	11.023
August	13.822	13.221	14.490	14.174	12.971	14.526	17.775	10.693
September	13.323	12.917	14.376	14.062	12.940	14.724	17.775	10.310
October	12.574	12.933	14.300	13.862	12.958	15.202	17.775	9.597
November	12.727	13.635	14.353	13.576	13.319	15.778	17.775	10.113
December	12.823	14.260	13.866	13.302	13.774	15.844	17.775	10.300
Average	14.421	13.024	14.042	13.795	12.920	14.570	18.107	12.982

ORE-CONCENTRATION STATISTICS

METALLURGICAL RESULTS, FLOTATION REAGENTS, AND BIBLIOGRAPHY [1]

By T. H. Miller and R. L. Kidd

CONTENTS

Page
- Introduction 749
- Acknowledgments 749
- Total ores concentrated 750
- Total consumption of reagents 751
- Copper ores 753
  - Sulphide copper ores 754
  - Copper-iron ores 757
  - Native copper ores 758
- Copper-lead ores 759
- Lead ores 761
- Lead-zinc ore 763
- Zinc ores 766
- Gold and silver ores 768
- Summary of reagent consumption 771
- Flotation of other ores 771
- Bibliography 774
  - Copper ores 775

Bibliography—Continued.

Page
  - Lead ores 779
  - Zinc ores 780
  - Lead-zinc ores 780
  - Gold-silver ores 782
  - Miscellaneous ores 784
  - General 785
    - Apparatus 785
    - Control 785
    - Reagents 785
    - Theory 786
    - Miscellaneous 787
  - Patents 788
    - Apparatus 788
    - Methods 789
    - Reagents 790

INTRODUCTION

The steady decline in the mining of high-grade smelting ores in recent decades has resulted in a gradual increase in the quantity of ore treated by concentration. In recent years flotation has become the chief method of concentration, and the growth of this method has been so rapid that at present nearly 81 per cent of the total nonferrous ore mined in the United States is being treated at concentration plants using flotation equipment. It is the purpose of this report to present the salient features of interest in the development of flotation concentration, relying largely upon basic statistical information to show metallurgical results and the importance of the latter to the economics of mining.

Summarized data on flotation concentration are of value not only to manufacturers of flotation reagents and equipment but also to operators of concentration plants, because they discuss the trend in the use of flotation reagents, give average metallurgical results at concentration plants, and indicate improvements in milling operations. The first report of the Bureau of Mines on flotation reagents, covering the year 1921, consisted largely of statistical tabulations on the consumption of flotation reagents. In later discussions additional information was included. This report, which covers statistics of metallurgical results and other summarized details on milling operations, also includes an annotated bibliography of flotation literature published during 1930. It is planned to add supplementary information in subsequent reports.

ACKNOWLEDGMENTS

The data summarized in this report have been collected from about 300 concentration plants in the United States. Individual mill reports were obtained by the field offices of the division of mineral statistics and were edited and tabulated in the Salt Lake City (Utah) office. The authors realize that the value of the report depends largely upon the completeness of the survey, and thanks are due the large number of individual plant operators who cooperated. The larger part of the annotated bibliography was prepared by the department of metallurgical research, University of Utah.

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[1] Work on manuscript completed March, 1932.

TOTAL ORES CONCENTRATED

Nonferrous metal mines in the United States produced about 76,725,000 tons of all classes of ore in 1930, a decided decrease from about 106,179,000 tons in 1929. The ore produced in 1930 was classified as follows: Gold and silver ore, 3,844,000 tons (5.01 per cent); copper ore, 47,676,000 tons (62.14 per cent); copper-lead ore, 352,000 tons (0.46 per cent); lead ore, 8,150,000 tons (10.62 per cent); lead-zinc ore, 10,509,000 tons (13.70 per cent); and zinc ore, 6,194,000 tons (8.07 per cent). Of the total ore produced about 3,677,000 tons (4.79 per cent) were of smelting grade; about 3,272,000 tons (4.27 per cent) were treated at gold and silver mills; about 4,450,000 tons (5.80 per cent) were treated by miscellaneous methods (chiefly leaching); and the remainder, about 65,326,000 tons (85.14 per cent) were treated at concentration plants.

Most of the ore of smelting grade was copper ore; the next largest amount was lead ore. This group includes a large quantity of siliceous gold and silver ore used as a flux at the smelting plants. The ore treated at gold and silver mills was almost entirely siliceous gold ore, gold and silver ore, and silver ore. This group includes all milling plants employing amalgamation or cyanidation or a combination of the two. Many of these plants have supplementary concentration equipment and produce concentrates as well as bullion. Ore treated at plants of this class is not included with that treated at concentration plants. (See Table 1.) The ore treated at miscellaneous plants was largely oxidized copper ore treated by sulphuric acid leaching and electrolysis. This group includes a quantity of native copper ore treated by ammonia leaching and a large quantity of ore treated by magnetic separation.

TABLE 1.—*Ore concentrated in the United States in 1930, by methods of concentration and classes of ores treated, in dry tons*

Class of ore	Method of concentration			
	Straight gravity	Combined gravity and flotation	Straight flotation	All methods
Gold and silver	17,978	570	264,505	283,053
Copper	900	8,255,080	32,896,735	41,152,715
Copper-lead	2	663	283,597	284,262
Lead	122,425	7,041,772	709,737	7,873,934
Lead-zinc	2,721,734	4,481,427	3,191,262	10,394,423
Zinc	458,172	3,729,790	1,149,105	5,337,067
Total	3,321,211	23,509,302	38,494,941	65,325,454

The larger part of the nonferrous ore mined in the United States (85.14 per cent) was treated by concentration. The classification of the ore concentrated is summarized in Table 1. Concentration plants are divided into three groups: (1) Straight gravity concentration without flotation equipment; (2) combined gravity and flotation concentration; and (3) straight flotation concentration without gravity equipment. Table 1 indicates that 5.08 per cent of the total ore concentrated was treated at straight gravity plants, 35.99 per cent at combined gravity and flotation plants, and 58.93 per cent at straight flotation plants; or a total of 94.92 per cent was treated at plants using flotation equipment. These figures compare with percentages of 3.63, 37.55, 58.82, and 96.37, respectively, in 1929. The slight increase in the proportion of the total ore treated at straight gravity plants does not indicate a trend toward the replacement of flotation equipment by gravity machines but is the result of the large decrease in the output of copper ore, most of which is treated by flotation, in 1930 as compared with 1929. In 1930, as in 1929, most of the copper ore treated by combined gravity and flotation methods was native copper ore treated at plants in Michigan. It is interesting to note that only an insignificant part of the total copper ore is treated at straight gravity-concentration plants and that nearly 90 per cent of the total lead ore concentrated (and more than 86 per cent of the total lead ore produced in the United States) in 1930 was treated at plants using combinations of gravity and flotation equipment. Most ore of this class is treated at mills located in the southeastern Missouri section, where flotation is used chiefly as a supplementary concentration operation. The large quantity of lead-zinc ore and zinc ore treated by combined gravity and flotation methods is produced chiefly at mines in the Tri-State region.

TOTAL CONSUMPTION OF REAGENTS

TABLE 2.—*Consumption of reagents in the treatment of all ores*

[Two hundred and thirty plants treating 47,259,022 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	190	35, 630, 136	4, 298, 623	0. 121
Cresylic acid	94	17, 823, 857	2, 773, 882	. 156
Orthotoluidine	3	184, 437	33, 435	. 181
Total frothers	224	46, 621, 044	7, 105, 940	. 152
II. Collectors:				
Distillation products—				
Coal-tar creosotes	60	4, 585, 993	605, 151	. 132
Wood-tar creosotes	23	4, 655, 073	266, 261	. 057
Petroleum products	5	396, 639	35, 493	. 089
Blast-furnace oils	5	2, 670, 646	197, 776	. 074
Water-gas tars	1	9, 766	2, 440	. 250
Total	78	10, 407, 406	1, 107, 121	. 106
Synthetic products—				
Ethyl xanthates	193	32, 930, 133	3, 568, 232	. 108
Butyl xanthates	11	12, 204, 542	309, 122	. 025
Amyl xanthates	30	10, 372, 060	232, 704	. 022
Xanthate derivatives	2	2, 349, 510	2, 096	. 001
Dicresol-dithiophosphoric acid	75	9, 251, 209	510, 770	. 055
Sodium dicresol-dithiophosphate	16	2, 528, 460	97, 856	. 039
Sodium diethyl-dithiophosphate	4	11, 915, 375	158, 474	. 013
Sodium dibutyl-dithiophosphate	3	106, 594	17, 024	. 160
Thiocarbanilide	15	3, 889, 404	117, 142	. 030
Alpha napthalamine	5	47, 854	4, 046	. 085
Oleic acid	1	60, 125	408	. 007
Total	225	46, 795, 937	5, 017, 874	. 107
Total collectors	230	47, 259, 022	6, 124, 995	. 130

TABLE 2.—*Consumption of reagents in the treatment of all ores*—Continued

[Two hundred and thirty plants treating 47,259,022 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
III. Acids and alkalies:				
Acids—sulphuric acid	3	483, 715	12, 060, 370	24. 933
Alkalies—				
Sodium carbonate	53	4, 933, 428	2, 072, 028	. 420
Sodium hydroxide	7	340, 472	87, 310	. 256
Lime	86	41, 017, 725	149, 527, 912	3. 645
Cement	1	331, 915	2, 736, 998	8. 246
Total	125	43, 380, 327	154, 424, 248	3. 560
IV. Other inorganic reagents:				
Sulphidizing—sodium sulphide	26	7, 960, 000	1, 226, 450	. 154
Activating—copper sulphate	123	7, 735, 579	5, 390, 166	. 697
Depressing—				
Cyanides	47	16, 857, 882	951, 062	. 056
Sodium sulphite	8	2, 056, 708	953, 954	. 464
Sodium silicate	17	595, 559	320, 828	. 539
Zinc sulphate	34	5, 026, 343	2, 125, 156	. 423
Sodium dichromate	2	150, 745	26, 693	. 177
Total	72	18, 288, 799	4, 377, 693	. 239
Miscellaneous—				
Calcium chloride	1	64, 083	12, 100	. 189
Sodium chloride	1	16, 625	1, 700	. 102
Linseed oils	2	35, 000	700	. 020
Total reagents	230	47, 259, 022	190, 724, 362	4. 036

Table 2 gives the total consumption of reagents in the treatment of 47,259,022 tons of ore at 230 plants in 1930.

Frothing reagents.—In 1930, as in 1929, pine oils, cresylic acid, and orthotoluidine were the only frothing reagents used. The total per ton consumption of frothing reagents was slightly greater than in 1929 and was substantially the same as in 1928. Frothing reagents were used in the treatment of 98.65 per cent of the ore in 1930, compared with 98.44 per cent in 1929. The necessary frothing reagent for the remainder of the ore was obtained from the collecting reagents. Pine oils continued to be the chief frothing reagent, amounting to more than 60 per cent of the total used in 1930 as compared with 55 per cent in 1929.

Collecting reagents.—Collecting reagents, tabulated under the heading "Synthetic products," and including xanthates, dithiophosphates, etc., for the last four or five years have rapidly been replacing collecting reagents of the "Distillation products" group. Of the total collecting reagents used during 1930, 81.92 per cent was of the synthetic group and 18.08 per cent of the distillation group, compared with 71.64 per cent and 28.36 per cent, respectively, in 1929, indicating a continuation of the trend. Several new synthetic collecting reagents were introduced during 1930, including sodium dibutyl-dithiophosphate and certain xanthate derivatives such as "Minerec." "Minerec" is described as a mixture of xanthagen formate and xanthic anhydride and is classified under the general heading "Xanthate derivatives." One plant reported the use of oleic acid in the treatment of sulphide lead-zinc ore. No benzyl mercaptan was reported in 1930.

Alkalies.—The per ton consumption of alkalies in 1930 was substantially the same as that in 1929; but the percentage of total ore treated using alkalies decreased from 96 in 1929 to 92 in 1930, partly because of the decreased use of alkalies in the treatment of native copper ores and partly because of the large decrease in the quantity of copper ore treated.

Other reagents.—The sharp decrease in the per ton consumption of sodium sulphide was due to the use of this reagent as a pyrite depressant at certain of the large copper concentrators. No important change was noted in the consumption of copper sulphate. This reagent is used universally as a zinc activator, and in 1930 its use as a pyrite activator was noted. No trisodium phosphate was used in 1930, and sodium dichromate was reported for the first time. There was an increase in the use of sodium sulphite in 1930 and a sharp decrease in the use of sodium silicate. Cyanides and zinc sulphate continued to be the chief depressing reagents. Fewer miscellaneous reagents were used in 1930; and the use of protective organic colloids, such as glue, starch, and gelatin, was not reported. The total per ton consumption of all reagents was slightly less than that in 1929.

TABLE 3.—*Comparison of consumption of reagents for 1925–1930*

	1925	1926	1927	1928	1929	1930
Ore treated____________thousands of tons__	45,490	50,889	50,073	59,064	65,405	47,259
Reagents, frothers__thousands of pounds__	4,835	6,464	6,583	9,052	9,283	7,106
Collectors:						
Distillation__________________do____	19,439	5,870	3,509	3,021	2,345	1,107
Synthetic____________________do____	4,133	4,179	5,767	4,863	5,925	5,018
Acids__________________________do____	40,028	4,540	9,749	12,442	12,099	12,060
Alkalies_______________________do____	3,733	166,889	176,766	215,858	234,598	154,424
Sulphidizing____________________do____	5,532	7,355	5,091	2,399	2,589	1,226
Activating_____________________do____	1,544	3,583	5,909	6,898	6,723	5,390
Depressing_____________________do____	1,660	2,432	7,140	9,500	6,050	4,393
Total______________________________	80,904	201,312	220,514	264,033	279,612	190,724
Reagent consumption, frothers ________pounds per ton of ore treated__	----------	----------	----------	0.155	0.144	0.152
Collectors:						
Distillation__________________do____	----------	----------	----------	.128	.124	.106
Synthetic____________________do____	----------	----------	----------	.082	.091	.107
Acids__________________________do____	----------	----------	----------	27.716	22.030	24.933
Alkalies_______________________do____	----------	----------	----------	3.873	3.735	3.560
Sulphidizing____________________do____	----------	----------	----------	.329	.713	.154
Activating_____________________do____	----------	----------	----------	.721	.627	.697
Depressing_____________________do____	----------	----------	----------	.287	.213	.239
Total______________________________	----------	----------	----------	4.470	4.275	4.036

Table 3 compares reagent consumption in the treatment of all ore from 1925 to 1930. A direct comparison of the per ton consumption of the various reagents is given for 1928, 1929, and 1930.

COPPER ORES

To tabulate flotation reagents the copper ores are divided into three classes: (1) Copper ores, including sulphide and oxidized copper ores from which only one concentrate was made; (2) copper-iron ores, including sulphide copper ores, from which copper concentrates and iron concentrates were made; and (3) native copper ores.

Mines in the United States in 1930 produced about 47,676,000 tons of copper ore of all classes, including copper-iron ore. Of this total, 41,152,715 tons (86.32 per cent) were treated at concentration plants.

Of the total copper ore concentrated about 32,897,000 tons were sulphide copper ore treated at straight flotation plants, about 1,595,000 tons were sulphide copper ore treated at combined gravity and flotation plants, about 448,000 tons were sulphide copper-iron ore treated at straight flotation plants, and most of the remainder was native copper ore treated at combined gravity and flotation plants. The total sulphide copper ore treated by flotation includes all of the ore treated at straight flotation plants and part of the ore treated at combined gravity and flotation plants.

TABLE 4.—*Consumption of reagents in the treatment of copper ores*

[Thirty-nine plants treating 34,050,473 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	34	24, 127, 694	3, 280, 746	0. 136
Cresylic acid	8	10, 019, 545	1, 900, 026	. 190
Orthotoluidine	1	28, 500	1, 700	. 060
Total frothers	37	33, 681, 213	5, 182, 472	. 154
II. Collectors:				
Distillation products—				
Coal-tar creosotes	3	29, 222	4, 147	. 142
Wood-tar creosotes	1	1, 906, 955	38, 055	. 020
Petroleum products	1	176, 680	11, 293	. 064
Blast-furnace oils	2	2, 631, 691	194, 076	. 074
Total	7	4, 744, 548	247, 571	. 052
Synthetic products—				
Ethyl xanthates	29	21, 514, 970	2, 074, 708	. 096
Butyl xanthates	5	12, 089, 042	303, 989	. 025
Amyl xanthates	7	9, 105, 718	72, 101	. 008
Xanthate derivatives	1	2, 327, 100	1, 500	. 001
Dicresol-dithiophosphoric acid	11	3, 247, 752	122, 274	. 038
Sodium dicresol-dithiophosphate	2	2, 169, 539	55, 670	. 026
Sodium diethyl-dithiophosphate	3	11, 879, 600	147, 074	. 012
Sodium dibutyl-dithiophosphate	2	70, 819	3, 024	. 043
Thiocarbanilide	1	28, 500	3, 100	. 109
Total	38	34, 049, 737	2, 783, 440	. 082
Total collectors	39	34, 050, 473	3, 031, 011	. 089
III. Acids[1] and alkalies, lime	36	34, 021, 251	141, 307, 284	4. 154
IV. Other inorganic reagents:[2]				
Sulphidizing—sodium sulphide	6	6, 851, 296	266, 048	. 039
Depressing—cyanides	6	10, 210, 196	384, 550	. 038
Total reagents	39	34, 050, 473	150, 171, 365	4. 410

[1] No acids consumed in 1930.

[2] No activating reagents consumed in 1930.

SULPHIDE COPPER ORES

Table 4 gives the consumption of reagents in the treatment of copper ores of class 1. A total of 34,050,473 tons of ore treated was reported by 39 plants, of which 3 were combined gravity and flotation plants and 36 were straight flotation plants. New plants completed and placed in operation during 1930 increased the number of plants treating this class of ore from 36 to 39. In 1929 six plants were classified as combined gravity and flotation plants. During 1930, however, three of these plants discontinued the use of gravity equipment and were operated as straight flotation plants. The total ore treated decreased from 51,513,791 tons in 1929 to 34,050,473 tons in 1930, due to the sharp curtailment measures adopted by the larger companies.

Flotation reagents.—The per ton consumption of frothing reagents increased slightly; pine oils continued to be the chief frothing reagents, followed by cresylic acid. There was a marked decrease in the consumption of cresylic acid, and five of the eight plants using this reagent also used pine oils. The apparent replacement of cresylic acid by pine oils may be explained partly by the unusually large decrease in ore treated at the larger plants using cresylic acid. One plant reported the use of orthotoluidine in conjunction with pine oils. In accordance with the trend indicated in recent years the consumption of distillation collectors (chiefly coal-tar creosotes) decreased decidedly, and in 1930 reagents of this class were used in the treatment of less than 14 per cent of the total copper ore, compared with 21 per cent in 1929. Of the 39 plants reporting, all but one plant used synthetic collectors. Ethyl xanthates continued to be the chief reagents in this group. There was a large increase in the consumption of butyl xanthates, and more plants reported the use of amyl xanthates. A new reagent of the xanthate group, marketed under the trade name of "Minerec," was reported in 1930 and tabulated under the heading of "Xanthate derivatives." Most of the users of the higher xanthates used ethyl xanthates in conjunction with them. Sodium dibutyl-dithiophosphate was reported for the first time in 1930. The per ton consumption of synthetic collectors increased slightly, but the per ton consumption of all collectors was substantially the same as in 1929. No acids were used in 1930, and lime was the only alkali reported as being used by 36 plants treating more than 99.9 per cent of the total copper ore. The number of plants using sodium sulphide increased; but the per ton consumption was very low, indicating that the reagent might have been used as a pyrite depressant rather than as a sulphidizing reagent. No important change was noted in the use of cyanides. Other depressing reagents, such as trisodium phosphate, were not used in 1930. Total reagent consumption per ton of ore treated decreased slightly.

TABLE 5.—*Comparison of metallurgical data in the treatment by straight flotation of copper ores for 1929 and 1930*

	1929	1930
Number of plants included	30	36
Total ore treated……dry tons	46,928,041	32,454,429
Gold content……ounces	364,752.19	254,045.62
Do……ounce per ton	0.008	0.008
Silver content……ounces	11,104,862	6,642,203
Do……ounce per ton	0.237	0.199
Copper content……pounds	1,318,289,930	876,387,325
Do……per cent	1.404	1.310
Concentrates produced……dry tons	2,480,356	1,681,819
Gold content……ounces	255,275.84	179,337.41
Do……ounce per ton	0.103	0.107
Silver content……ounces	9,712,878	5,778,577
Do……ounces per ton	3.916	3.436
Copper content……pounds	1,154,093,479	782,507,042
Do……per cent	23.265	23.263
Ratio of concentration, ore : concentrates	18.92:1	19.30:1
Gold recovery……per cent	69.99	70.59
Silver recovery……do	87.47	87.00
Copper recovery……do	87.54	89.29

Metallurgical results.—In 1930, for the first time, detailed metallurgical reports were received from all 39 plants treating copper ores. The data reported by the 36 straight flotation plants are summarized in Table 5, which also shows comparative figures from 30 plants in 1929. It will be noted that the assay content of copper in the ore treated decreased from 1.404 per cent in 1929 to 1.310 per cent in 1930, indicating a continued decrease in the grade of ore treated. The grade of the concentrate produced was substantially the same as that in 1929; but the ratio of concentration and recovery of copper were higher, indicating an improvement in operations.

The three combined gravity and flotation plants treated 1,596,044 tons of ore and produced 205,742 tons of concentrates—an indicated ratio of concentration of 7.76:1. The recoveries in 1930 were: Gold, 89.40 per cent; silver, 92.69 per cent; and copper, 87.82 per cent. The 1929 recoveries were: Gold, 88.88 per cent; silver, 92.84 per cent; and copper, 83.91 per cent. The higher recoveries of gold and silver at the combined gravity and flotation plants, as compared with the straight flotation plants, was due to the much higher grade of material treated at one plant and does not indicate that higher recoveries of gold and silver could be made at combined gravity and flotation plants on copper ore of average gold and silver content.

Screen analysis.—A comparison of the average screen analyses of flotation feed for 1929 and 1930 follows:

	1929	1930
Number of plants	22	31
Ore treated tons	46, 284, 546	33, 967, 845
+65 mesh per cent	7. 99	7. 80
−65+100 mesh do	9. 44	11. 15
−100+150 mesh per cent	9. 55	10. 42
−150+200 mesh do	10. 23	10. 44
−200 mesh do	62. 79	60. 19

The coarser flotation feed reported in 1930 may be partly explained by the inclusion of a larger number of small milling plants. The higher average recovery of copper in 1930, however, would seem to indicate that grinding and classifying units were more efficiently operated, the units grinding enough to liberate mineral from gangue but doing less wasted grinding. Recent changes in the classifier circuits of several plants strengthen this reasoning.

Alkalinity.—Alkalinity, measured in terms of pH units, was reported by 18 plants treating 26,107,615 tons of ore. The calculated average indicated a pH of 9.50. In 1930, as in 1929, many plants reported alkalinity in terms of CaO, and no direct comparison or calculation of average alkalinity can be made. The average pH for 1929 was not calculated; the pH ranged from 7.0 to 13.0.

COPPER-IRON ORES

TABLE 6.—*Consumption of reagents in the treatment of copper-iron ores*

[Two plants treating 447,940 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers, pine oils	2	447,940	34,840	0.078
II. Collectors:				
Distillation products, coal-tar creosotes	1	331,915	2,037	.006
Synthetic products:—				
Ethyl xanthates	2	447,940	82,220	.185
Amyl xanthates	1	116,025	8,200	.071
Dicresol-dithiophosphoric acid	1	331,915	41,669	.126
Total	2	447,940	132,089	.295
Total collectors	2	447,940	134,126	.299
III. Acids and alkalies:				
Acids—sulphuric acid	2	447,940	11,850,600	26.456
Alkalies—				
Lime	2	447,940	724,700	1.618
Cement	1	331,915	2,736,998	8.246
Total	2	447,940	3,461,698	7.728
IV. Other inorganic reagents,[1] activating—copper sulphate	1	331,915	220,500	.664
Total reagents	2	447,940	15,701,764	35.053

[1] No sulphidizing reagents consumed in 1930.

In 1930, as in 1929, two plants treated sulphide copper-iron ores, making two or more concentrates. The treatment of this ore, in so far as the copper content is concerned, is substantially the same as that of other sulphide copper ores; however, the supplementary operations, employed to recover iron concentrates and, in one case, zinc concentrates, are entirely different from the flotation operations practiced elsewhere on sulphide copper ores. It has therefore been found necessary to classify the ore as a separate group. The copper concentrates are shipped directly to copper smelters, and the pyrite concentrates are used locally in the manufacture of sulphuric acid. The acid-plant calcines are shipped to iron smelters.

Flotation reagents.—The consumption of flotation reagents for copper-iron ores is summarized in Table 6. There was a marked decrease in the per ton consumption of pine oils in 1930 compared with 1929. One plant discontinued the use of coal-tar creosote, and one plant reported the use of amyl xanthate. The per ton consumption of collecting reagents decreased, and the consumption of both acids and alkalies increased. In 1930, as in 1929, nearly all the sulphuric acid employed in flotation was used by these plants in the pyrite circuit. Copper sulphate was used as a zinc activator.

Metallurgical results.—Reports received from plants treating copper-iron ore in 1929 were not sufficiently complete to permit calculation of average results; thus, no comparisons can be made with 1930 operations. The two plants operating in 1930 treated 447,940 tons of ore containing 11,501,908 pounds of copper, 6,995,765 pounds of zinc, and 300,775,280 pounds of iron. The production amounted to 35,198 tons of copper concentrates containing 9,886,290 pounds of copper, 1,460,422 pounds of zinc, and 26,448,600 pounds of iron; 2,535 tons of zinc concentrates containing 55,770 pounds of copper, 2,529,930 pounds of zinc, and 684,450 pounds of iron; and 201,490 tons of iron concentrates containing 1,145,874 pounds of copper, 1,679,643 pounds of zinc, and 219,423,980 pounds of iron. The ratio of concentration of ore to copper concentrates was 12.73:1, and the recovery of copper in copper concentrates was 85.95 per cent.

Screen analysis.—The average screen analysis reported by the two plants was 6.82 per cent $+65$ mesh, 12.65 per cent $-65+100$ mesh, 14.26 per cent $-100+150$ mesh, 13.96 per cent $-150+200$ mesh, and 52.31 per cent -200 mesh.

Alkalinity.—The average alkalinity reported by the two plants, expressed in terms of pH units, was as follows: Copper circuit, 10.5; zinc circuit, 11.3; and iron circuit, 6.5.

NATIVE COPPER ORES

TABLE 7.—*Consumption of reagents in the treatment of native copper ores*

[Five plants treating 2,346,070 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers, pine oils	5	2,346,070	281,061	0.120
II. Collectors:				
Distillation products, wood-tar creosotes	1	709,425	8,000	.011
Synthetic products—				
Ethyl xanthate	4	2,086,070	162,700	.078
Dicresol-dithiophosphoric acid	1	260,000	36,144	.139
Total	5	2,346,070	198,844	.085
Total collectors	5	2,346,070	206,844	.088
III. Acids[1] and alkalies, lime	1	709,425	200,000	.282
IV. Other reagents, total	5	2,346,070	687,905	.293

[1] No acids consumed in 1930.

According to reports to the Bureau of Mines, Michigan mines produced more than 6,600,000 tons of native copper ore during 1930. The ore was of milling grade and was treated in plants using a combination of either gravity and flotation concentration or gravity and flotation concentration and ammonia leaching. Detailed reports were received from five milling plants treating 6,176,697 tons of ore. None of these plants treated the entire mill feed by flotation. In all cases a gravity tailing was produced which was either discarded or treated by leaching. The flotation sections treated only the classifier overflow from the primary and secondary grinding units. The total material treated by flotation amounted to 2,346,070 tons.

Flotation reagents.—Table 7 gives the data on consumption of reagents for the five plants. Comparing this table with similar data for 1929 it appears that there were no important changes in the use of frothers and collectors. In 1929 three plants reported the use of sodium carbonate and one used lime. In 1930, however, no sodium carbonate was used, but one plant continued to use lime. Apparently, the absence of acid-forming minerals in the material treated has eliminated the need for the strongly alkaline circuits commonly used in the selective flotation of sulphide copper ores.

Metallurgical results.—The total ore (6,176,697 tons) milled by the five plants reporting contained 169,733,360 pounds of copper. The production consisted of 99,269 tons of gravity concentrates containing 140,778,802 pounds of copper and 18,659 tons of flotation concentrates containing 15,783,937 pounds of copper. The over-all ratio of concentration was 52.38:1, and the copper recovery was 92.24 per cent.

Screen analysis.—The five plants reported an average screen analysis of flotation feed as follows: 12.68 per cent+65 mesh, 15.18 per cent −65+100 mesh, 6.61 per cent −100+150 mesh, 6.49 per cent −150+200 mesh, and 59.04 per cent −200 mesh.

Alkalinity.—The five plants reported an average alkalinity expressed in terms of pH units of 8.61.

COPPER-LEAD ORES

TABLE 8.—*Consumption of reagents in the treatment of copper-lead ores*

[Six plants treating 283,260 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	5	269,405	35,660	0.132
Cresylic acid	1	13,855	4,156	.300
Total frothers	6	283,260	39,816	.141
II. Collectors:				
Distillation products—				
Coal-tar creosotes	1	147,948	4,400	.030
Wood-tar creosotes	1	147,948	18,000	.121
Total	1	147,948	22,400	.151
Synthetic products—				
Ethyl xanthates	4	35,171	2,807	.080
Amyl xanthates	2	114,803	4,832	.042
Dicresol-dithiophosphoric acid	1	20,353	3,050	.150
Thiocarbanilide	1	20,353	1,890	.093
Total	5	135,312	12,579	.093
Total collectors	6	283,260	34,979	.123
III. Acids [1] and alkalies:				
Alkalies—				
Sodium carbonate	1	20,353	37,860	1.860
Lime	2	100,441	11,300	.113
Total	3	120,794	49,160	.407
IV. Other inorganic reagents: [2]				
Sulphidizing—sodium sulphide	1	663	2,360	3.560
Depressing—cyanides	1	20,353	6,170	.304
Total reagents	6	283,260	132,485	.468

[1] No acids consumed in 1930.

[2] No activating reagents consumed in 1930.

This class includes considerable ore valuable chiefly for its gold or silver content and containing minor amounts of copper and lead. The material is classified as copper-lead ore because the gold and silver are recovered in a copper-lead concentrate, and the metallurgical treatment of it is similar to that of the higher-grade copper-lead ores.

Flotation reagents.—Comparison of the data given in Table 8 with a similar table for 1929 indicates several changes in the consumption of reagents, due chiefly to the closing of one large producer included in the 1929 table. There was a decided decrease in the consumption of all reagents, notably alkalies, synthetic collectors, and depressing reagents. The decrease in the per ton consumption of collectors is due largely to the lower sulphide mineral content of the ore treated.

TABLE 9.—*Comparison of metallurgical data in the treatment of copper-lead ores for 1929–1930*

	1929	1930
Number of plants included	9	6
Total ore treated ..... dry tons	312, 106	283, 260
Gold content ..... ounces	6, 288. 27	20, 905. 12
Do ..... ounce per ton	0. 020	0. 074
Silver content ..... ounces	3, 260, 916	3, 153, 237
Do ..... ounces per ton	10. 448	11. 132
Copper content ..... pounds	6, 948, 206	2, 768, 772
Do ..... per cent	1. 113	0. 489
Lead content ..... pounds	14, 731, 704	4, 882, 421
Do ..... per cent	2. 363	0. 862
Copper-lead concentrates ..... dry tons	33, 373	12, 823
Gold content ..... ounces	4, 017. 23	18, 357. 72
Do ..... ounces per ton	0. 120	1. 432
Silver content ..... ounces	2, 961, 021	2, 955, 561
Do ..... ounces per ton	88. 725	230. 489
Copper content ..... pounds	5, 637, 538	2, 440, 470
Do ..... per cent	8. 446	9. 516
Lead content ..... pounds	13, 064, 074	4, 327, 865
Do ..... per cent	19. 573	16. 875
Ratio of concentration, ore : concentrates	9. 35 : 1	22. 09 : 1
Gold recovery ..... per cent	63. 88	87. 81
Silver recovery ..... do	90. 80	93. 73
Copper recovery ..... do	81. 14	88. 14
Lead recovery ..... do	88. 56	88. 64

Metallurgical results.—Table 9 compares metallurgical results for 1929 and 1930. The changes in the grade of the material treated and concentrates produced are noteworthy, particularly for gold and silver. These changes explain to a large degree the improvement in the recovery of gold and silver. The decidedly higher ratio of concentration was due to the closing of one combined gravity and flotation plant.

Screen analysis.—A comparison of the fineness of flotation feed for 1929 and 1930 follows.

	1929	1930		1929	1930
Number of plants	3	4	−100+150 mesh ..... per cent	12. 73	12. 51
Ore treated ..... dry tons	127, 866	282, 297	−150+200 mesh ..... do	16. 19	15. 84
+65 mesh ..... per cent	4. 73	8. 59	−200 mesh ..... do	50. 50	47. 19
−65+100 mesh ..... do	15. 85	15. 87			

Alkalinity.—Alkalinity was reported by three plants treating 134,349 tons of ore; the average pH unit was 8.22, compared with 7.0 to 8.2 in 1929.

LEAD ORES

In the United States in 1930 about 8,150,000 tons of lead ore were produced, of which 7,873,934 tons (96.61 per cent) were treated at concentration plants. Most of the remainder was lead ore of smelting grade. Of the lead ore concentrated nearly 90 per cent was treated at combined gravity and flotation plants. These plants discard part of the gravity-section tailings as a final waste product; the remainder, together with the primary slime product, is advanced to the flotation division. This material and the ore treated at the straight flotation plants accounted for the 5,211,890 tons of lead material treated by flotation at 38 plants in 1930, as given in Table 10.

TABLE 10.—*Consumption of reagents in the treatment of lead ores*

[Thirty-eight plants treating 5,211,890 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	24	4,190,217	147,221	0.035
Cresylic acid	21	5,021,114	590,405	.118
Total frothers	35	5,073,355	737,626	.145
II. Collectors:				
Distillation products—				
Coal-tar creosotes	6	1,421,802	29,349	.021
Wood-tar creosotes	2	19,926	310	.016
Blast-furnace oils	1	1,326	130	.098
Total	8	1,441,728	29,789	.021
Synthetic products—				
Ethyl xanthates	31	4,780,760	472,824	.099
Amyl xanthates	6	380,731	90,299	.237
Dicresol-dithiophosphoric acid	16	3,322,522	145,911	.044
Sodium diethyl-dithiophosphate	1	35,775	11,400	.319
Sodium dibutyl-dithiophosphate	1	35,775	14,000	.391
Thiocarbanilide	4	2,942,231	11,600	.004
Oleic acid	1	60,125	408	.007
Total	37	5,211,850	746,442	.143
Total collectors	38	5,211,890	776,231	.149
III. Acids and alkalies:				
Acids—sulphuric acid	1	35,775	209,770	5.864
Alkalies—				
Sodium carbonate	18	2,956,433	333,131	.113
Lime	7	3,661,269	1,197,705	.327
Total	21	4,572,726	1,530,836	.335
IV. Other inorganic reagents:				
Sulphidizing—sodium sulphide	6	196,237	467,969	2.385
Activating—copper sulphate	6	2,622,535	272,920	.104
Depressing—				
Cyanides	14	4,896,080	133,191	.027
Sodium sulphite	2	1,243,676	10,110	.008
Sodium silicate	3	142,708	215,558	1.510
Zinc sulphate	9	2,918,761	278,266	.095
Total	21	5,076,474	637,125	.126
Total reagents	38	5,211,890	4,632,477	.889

Flotation reagents.—A comparison of Table 10 with similar data for 1929 indicates several changes in the consumption of reagents. Cresylic acid continued to be the chief frothing reagent, with pine oils next; 10 plants used both cresylic acid and pine oils. The per ton consumption of all frothers was slightly higher than in 1929. The trend toward the replacement of distillation collectors by synthetic collectors continued in 1930, with a marked increase in the use of ethyl xanthates. The total consumption of dithiophosphates was about the same as in 1929, but one plant substituted dicresol-dithiophosphoric acid for sodium dicresol-dithiophosphate reported in 1929. The total per ton consumption of all collectors was substantially the same as in 1929. In 1930, as in 1929, sulphuric acid was reported by one plant treating an oxidized lead ore. There were marked decreases in the consumption of lime and sodium sulphide. The use of depressing reagents remained the same, but the per ton consumption of total reagents decreased sharply.

TABLE 11.—*Comparison of metallurgic results in the treatment of lead ores in 1929 and 1930*

	1929	1930
Number of plants	23	38
Total ore treated......dry tons	1, 163, 456	7, 738, 110
Gold content......ounces	13, 937. 75	13, 790. 78
Do......ounce per ton	0. 012	0. 002
Silver content......ounces	6, 656, 074	5, 716, 575
Do......ounces per ton	5. 721	0. 739
Copper content......pounds	1, 322, 729	1, 800, 156
Do......per cent	0. 050	0. 011
Lead content......pounds	213, 951, 139	624, 731, 971
Do......per cent	9. 19	4. 037
Zinc content......pounds	20, 268, 896	41, 756, 473
Do......per cent	1. 44	0. 270
Lead concentrates produced......dry tons	176, 464	451, 899
Gold content......ounces	9, 613. 86	10, 281. 93
Do......ounce per ton	0. 054	0. 023
Silver content......ounces	5, 677, 170	5, 074, 930
Do......ounces per ton	32. 172	11. 230
Copper content......pounds	847, 737	1, 356, 732
Do......per cent	0. 240	0. 150
Lead content......pounds	191, 140, 685	584, 499, 350
Do......per cent	54. 159	64. 671
Zinc content......pounds	(1)	(1)
Do......per cent	(1)	(1)
Other concentrates produced......dry tons	16, 323	17, 190
Silver content......ounces	74, 161	174, 103
Do......ounces per ton	4. 543	10. 128
Copper content......pounds	47, 022	44, 584
Do......per cent	0. 144	0. 130
Lead content......pounds	1, 607, 609	857, 603
Do......per cent	4. 924	2. 494
Zinc content......pounds	4, 631, 933	16, 952, 200
Do......per cent	14. 188	49. 308
Ratio of concentration, ore: lead concentrates	6. 59:1	17. 12:1
Recoveries:		
Gold in lead concentrates......per cent	68. 98	74. 56
Silver in lead concentrates......do	85. 29	88. 78
Copper in lead concentrates......do	64. 09	75. 37
Lead in lead concentrates......do	89. 34	93. 56
Gold in all concentrates......do	68. 98	74. 56
Silver in all concentrates......do	86. 41	90. 95
Copper in all concentrates......do	67. 64	77. 85
Lead in all concentrates......do	90. 00	93. 70
Zinc in all concentrates......do	22. 85	40. 60

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[1] Not reported.

Metallurgical results.—Complete metallurgical reports were received from 38 plants treating 7,738,110 tons of ore in 1930, compared with 23 plants treating 1,163,456 tons in 1929. The large increase in the tonnage of ore reported was due to the fact that complete reports were received for the first time from the large mills in southeastern Missouri. The ore treated in these mills contained no gold, very little silver and copper, and much less lead than the lead ore treated elsewhere. These facts account for the marked changes in assay content of the ore milled, as shown in Table 11. The lead concentrates produced at the Missouri plants were much richer in lead than the average, which accounts for the increase in lead content from 54.159 per cent in 1929 to 64.671 per cent in 1930. Due to the lower grade of the material treated the ratio of concentration was considerably higher. The zinc content of the ore milled was reported only by those plants that made zinc or lead-zinc concentrates and does not indicate the actual zinc content of the total ore milled. "Other concentrates" in Table 11 include zinc, lead-zinc, and iron concentrates. There were notable improvements in the recoveries of all five metals, particularly zinc and copper.

Screen analysis.—A comparison of the screen analysis of flotation feed for 1929 and 1930 follows.

	1929	1930		1929	1930
Number of plants	14	20	−100+150 mesh___per cent__	10. 75	10. 24
Ore treated________dry tons__	1, 105, 830	5, 159, 705	−150+200 mesh_______do____	11. 08	11. 31
+65 mesh_________per cent__	3. 07	4. 98	−200 mesh____________do____	66. 98	63. 13
−65+100 mesh________do____	8. 12	10. 34			

Alkalinity.—In 1930 reports from 18 plants treating 5,062,388 tons of ore, giving the alkalinity of the lead circuit, indicated an average pH of 8.11. In 1929 seven plants reported alkalinities of 7.0 to 8.0 pH.

LEAD-ZINC ORE

During 1930 mines in the United States produced about 10,509,000 tons of lead-zinc ore. Nearly all the ore (98.91 per cent) was treated at concentration plants; most of the remainder was treated at magnetic separation plants. Of the lead-zinc ore concentrated about 31 per cent was treated at straight flotation plants, most of which are located in the Western States, 43 per cent was treated in combined gravity and flotation plants, and 26 per cent was treated in straight gravity plants. Most of the mills of the latter classes are located in the Central States. Part of the ore treated at the combined gravity and flotation plants is advanced to the flotation division in the form of primary slime. This material, together with the ore treated at straight flotation plants, is considered feed to flotation in Table 12.

TABLE 12.—*Consumption of reagents in the treatment of lead-zinc ores*

[70 plants treating 3,195,948 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	56	2,597,913	308,025	0.119
Cresylic acid	40	2,337,180	241,572	.103
Orthotoluidine	1	155,717	31,700	.204
Total frothers	69	3,064,765	581,297	.190
II. Collectors:				
Distillation products—				
Coal-tar creosotes	25	1,770,290	456,848	.258
Wood-tar creosotes	12	1,657,894	187,636	.113
Petroleum products	1	175,645	17,000	.097
Blast-furnace oils	1	22,379	2,120	.095
Total	30	2,026,739	663,604	.327
Synthetic products—				
Ethyl xanthates	64	2,736,623	539,843	.197
Butyl xanthates	6	115,500	5,133	.044
Amyl xanthates	4	516,392	47,300	.092
Xanthate derivatives	1	22,410	596	.027
Dicresol-dithiophosphoric acid	24	1,555,598	123,356	.079
Sodium dicresol-dithiophosphate	7	245,565	33,146	.135
Thiocarbanilide	8	612,605	67,852	.111
Total	68	2,881,587	817,226	.284
Total collectors	70	3,195,948	1,480,830	.463
III. Acids [1] and alkalies:				
Alkalies—				
Sodium carbonate	21	1,568,600	1,478,102	.942
Sodium bicarbonate	1	138,716	34,680	.250
Sodium hydroxide	3	276,912	84,150	.304
Lime	18	1,474,010	4,069,150	2.761
Total	31	2,237,602	5,666,082	2.532
IV. Other inorganic reagents:				
Sulphidizing—sodium sulphide	4	793,551	436,045	.549
Activating—copper sulphate	70	3,195,948	3,359,374	1.051
Depressing—				
Cyanides	22	1,532,971	382,986	.250
Sodium sulphite	6	813,032	943,844	1.161
Sodium silicate	6	250,286	52,342	.209
Zinc sulphate	24	2,097,389	1,837,060	.876
Sodium dichromate	2	150,745	26,693	.177
Total	34	2,609,842	3,242,925	1.243
Miscellaneous—				
Calcium chloride	1	64,083	12,100	.189
Sodium chloride	1	16,625	1,700	.102
Total reagents	70	3,195,948	14,780,353	4.625

[1] No acids consumed in 1930.

Flotation reagents.—Data on the consumption of reagents in the treatment of lead-zinc ores are given in Table 12. No important changes are indicated by a comparison with similar data for 1929. Pine oils became the chief frothing reagent, replacing cresylic acid. One plant used orthotoluidine in 1930, compared with three in 1929, and 27 plants used both cresylic acid and pine oils. Consumption of wood-tar creosotes increased, but the total distillation collectors decreased slightly, due to decreases in the use of coal-tar creosotes and blast-furnace oils. The consumption of alkalies, sodium sulphide, and copper sulphate was slightly higher in 1930. Sodium dichromate, used as a lead depressant, was reported by two plants in 1930.

TABLE 13.—*Comparison of metallurgic results in the treatment of complex lead-zinc-iron ores in 1929 and 1930*

	Method of concentration and year		
	Straight flotation		Combined gravity and flotation
	1929	1930	1930
Number of plants	35	29	26
Total ore treated dry tons	3, 341, 260	2, 475, 432	3, 000, 528
Gold content ounces	104, 222. 53	82, 031. 01	5, 179. 22
Do ounce per ton	0. 031	0. 033	0. 002
Silver content ounces	17, 281, 331	14, 250, 967	714, 763
Do ounces per ton	5. 172	5. 757	0. 238
Copper content pounds	19, 613, 092	15, 976, 760	830, 475
Do per cent	0. 293	0. 323	0. 014
Lead content pounds	404, 158, 708	342, 563, 646	77, 640, 339
Do per cent	6. 048	6. 919	1. 298
Zinc content pounds	494, 952, 371	420, 723, 844	209, 312, 838
Do per cent	7. 406	8. 498	3. 488
Lead concentrates produced dry tons	302, 559	265, 711	46, 726
Gold content ounces	54, 738. 49	47, 812. 94	1, 755. 13
Do ounce per ton	0. 181	0. 180	0. 038
Silver content ounces	12, 315, 022	10, 532, 100	431, 370
Do ounces per ton	40. 703	39. 637	9. 232
Copper content pounds	11, 573, 155	9, 788, 510	318, 420
Do per cent	1. 913	1. 842	0. 341
Lead content pounds	337, 252, 774	294, 376, 483	59, 045, 314
Do per cent	55. 733	55. 394	63. 182
Zinc content pounds	43, 998, 906	39, 038, 750	3, 050, 500
Do per cent	7. 271	7. 346	3. 264
Zinc concentrates produced dry tons	385, 949	331, 383	153, 994
Gold content ounces	13, 544. 78	9, 274. 05	794. 01
Do ounce per ton	0. 035	0. 028	0. 005
Silver content ounces	2, 760, 110	1, 975, 295	105, 229
Do ounces per ton	7. 151	5. 961	0. 683
Copper content pounds	4, 828, 037	3, 221, 234	247, 429
Do per cent	0. 625	0. 486	0. 080
Lead content pounds	26, 488, 753	18, 670, 949	5, 551, 083
Do per cent	3. 432	2. 817	1. 802
Zinc content pounds	399, 541, 944	345, 265, 710	173, 121, 987
Do per cent	51. 761	52. 095	56. 211
Iron concentrates produced dry tons	67, 364	64, 535	3, 721
Gold content ounces	7, 960. 90	8, 664. 66	52. 90
Silver content do	234, 054	168, 495	4, 005
Copper content pounds	469, 887	281, 671	1, 021
Lead content do	2, 229, 949	2, 335, 350	43, 366
Zinc content do	4, 661, 589	4, 618, 840	148, 840
Ratio of concentration:			
Ore: lead concentrates	11. 04:1	9. 32:1	64. 21:1
Ore: zinc concentrates	8. 66:1	7. 47:1	19. 48:1
Ore: iron concentrates	49. 60:1	38. 36:1	------------
Ore: all concentrates	4. 42:1	3. 80:1	14. 68:1
Recoveries:			
Gold in lead concentrates per cent	52. 52	58. 29	33. 89
Gold in zinc concentrates do	13. 00	11. 31	15. 33
Gold in iron concentrates do	7. 64	10. 56	1. 02
Gold in all concentrates do	75. 16	80. 16	50. 24
Silver in lead concentrates do	71. 26	73. 90	60. 35
Silver in zinc concentrates do	15. 97	13. 86	14. 72
Silver in iron concentrates do	1. 35	1. 18	0. 56
Silver in all concentrates do	88. 58	88. 94	75. 63
Copper in lead concentrates do	59. 01	61. 27	38. 34
Copper in zinc concentrates do	24. 61	20. 16	29. 79
Copper in iron concentrates do	2. 40	1. 76	0. 01
Copper in all concentrates do	86. 02	83. 21	68. 14
Lead in lead concentrates do	83. 45	85. 93	76. 05
Lead in zinc concentrates do	6. 55	5. 45	7. 15
Lead in iron concentrates do	0. 55	0. 68	0. 06
Lead in all concentrates do	90. 55	92. 06	83. 26
Zinc in lead concentrates do	8. 89	9. 28	1. 46
Zinc in zinc concentrates do	80. 72	82. 06	82. 71
Zinc in iron concentrates do	0. 94	1. 10	0. 07
Zinc in all concentrates do	90. 55	92. 44	84. 24

Metallurgical results.—Table 13 summarizes all the available metallurgical data for 1929 and 1930. Detailed reports were received from a large number of plants treating lead-zinc ore by combined gravity and flotation in 1930. In view of the difference in grade of ore treated and in method of treatment it appeared advisable to tabulate the data for the combined gravity and flotation plants separately from that for the straight flotation plants. The results obtained at straight flotation plants in 1930 compared with those in 1929 indicate a general improvement in metallurgical practice, as shown by the higher over-all recoveries of gold, silver, lead, and zinc. Part of this apparent improvement may be due to the higher average grade of material treated. Comparing the straight flotation plants with the combined gravity and flotation plants for 1930 would, at first glance, indicate that better results are obtained by the straight flotation plants; however, part of the difference may be accounted for by the decidedly lower grade of ore treated at the combined gravity and flotation plants.

Screen analysis.—Screen analyses of the feed to flotation in 1929 and 1930 are compared below.

	1929	1930		1929	1930
Number of plants	24	25	−100+150 mesh...per cent..	8.43	8.30
Ore treated.......dry tons..	3,008,945	2,552,686	−150+200 mesh.......do....	11.83	11.47
+65 mesh.........per cent..	5.23	5.69	−200 mesh............do....	66.93	66.39
−65+100 mesh........do....	7.58	8.15			

Alkalinity.—A comparison of the average alkalinity, given in terms of pH values, of the three circuits for 1929 and 1930 follows.

	1929	1930
Number of plants	20	36
Ore treated.......dry tons..	2,734,731	2,453,978
Alkalinity:		
Lead circuit.......pH units..	7.93	7.92
Zinc circuit.......do....	8.41	8.36
Iron circuit.......do....	7.99	8.00

ZINC ORES

The zinc ore produced by mines in the United States in 1930 totaled about 6,194,000 tons. Most of the ore (5,337,067 tons) was concentrated; and the remainder was treated at miscellaneous plants, chiefly by magnetic separation. Most of the ore concentrated was treated at combined gravity and flotation plants. The feed to flotation, consisting of the ore treated at straight flotation plants and primary slime from combined gravity and flotation plants, as reported by 44 plants in 1930, amounted to 1,504,237 tons. The large decrease in the quantity of zinc ore treated in 1930, compared with that in 1929, is due chiefly to a change in the classification of much of the zinc ore from the Central States.

TABLE 14.—*Consumption of reagents in the treatment of zinc ores*

[Forty-four plants treating 1,504,237 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	39	1,446,583	191,286	0.132
Cresylic acid	19	364,772	33,306	.091
Total frothers	44	1,504,237	224,592	.149
II. Collectors:				
Distillation products—				
Coal-tar creosotes	19	825,546	105,632	.128
Wood-tar creosotes	5	212,260	14,135	.067
Petroleum products	1	32,332	2,245	.069
Blast-furnace oils	1	15,250	1,450	.095
Total	22	933,186	123,462	.132
Synthetic products—				
Ethyl xanthates	38	1,166,068	213,681	.183
Amyl xanthates	1	22,560	200	.009
Dicresol-dithiophosphoric acid	18	393,653	32,498	.083
Sodium dicresol-dithiophosphate	6	111,432	8,840	.079
Thiocarbanilide	1	285,715	32,700	.114
Alpha-naphthalamine	5	47,854	4,046	.085
Total	44	1,504,237	291,965	.194
Total collectors	44	1,504,237	415,427	.276
III. Acids[1] and alkalies:				
Alkalies—				
Sodium carbonate	7	229,467	159,025	.693
Sodium hydroxide	4	63,560	3,160	.050
Lime	17	556,520	1,993,603	3.582
Total	23	1,203,861	2,155,788	1.791
IV. Other inorganic reagents:				
Sulphidizing—sodium sulphide	1	32,332	375	.012
Activating—copper sulphate	44	1,504,237	1,529,287	1.017
Depressing—				
Cyanides	3	188,089	41,290	.220
Sodium silicate	7	192,372	46,310	.241
Total	9	361,741	87,600	.242
Miscellaneous—Linseed oil	2	35,000	700	.020
Total reagents	44	1,504,237	4,413,769	2.934

[1] No acids consumed in 1930.

Flotation reagents.—The consumption data on flotation reagents used in the treatment of zinc ores are summarized in Table 14. No changes of any importance are indicated by comparison of this table with similar data for 1929. The per ton consumption figures for the various reagents are substantially the same as those in 1929; but other comparisons, particularly that of the number of plants using each reagent, are not reliable, due to the changes in classification of a large tonnage of ore tabulated as zinc ore in 1929.

TABLE 15.—*Metallurgical data in the treatment of zinc ores in 1930*

TOTAL CONTENT OF MILL FEED AND PRODUCTS

	Tons	Gold, ounces	Silver, ounces	Copper, pounds	Lead, pounds	Zinc, pounds
Mill feed	2,218,923	653.00	524,008	347,629	4,200,822	175,108,475
Lead concentrates	1,421	128.68	188,227	103,889	1,889,298	180,386
Zinc concentrates	125,813	225.79	260,960	196,371	1,299,308	147,664,574
Total concentrates	127,234	354.47	449,187	300,260	3,188,606	147,844,960

ASSAY OF MILL FEED AND PRODUCTS

	Gold, ounce per ton	Silver, ounces per ton	Copper, per cent	Lead, per cent	Zinc, per cent
Mill feed	0.0003	0.236	0.008	0.095	3.946
Lead concentrates	.0910	132.461	3.605	66.478	6.347
Zinc concentrates	.0018	2.074	.078	5.164	58.684

RECOVERIES (PER CENT)

	Ratio of concentration	Gold	Silver	Copper	Lead	Zinc
Lead concentrates	----------	19.71	35.92	29.88	44.97	0.10
Zinc concentrates	17.64:1	34.58	49.80	56.49	30.93	84.33
Total concentrates	17.44:1	54.29	85.72	86.37	75.90	84.43

Metallurgical results.—Fairly complete metallurgical data were reported by 22 mills treating 2,218,923 tons of ore. Of the 22 mills 12 were straight flotation plants, and 10 used combined gravity and flotation equipment. The metallurgical results in the treatment of this ore are summarized in Table 15. No similar data for 1929 are available, and no direct comparison can be made.

Screen analysis.—Screen analyses of flotation feed were reported by nine plants treating 664,808 tons of ore. The calculated average was: 11.40 per cent, +65 mesh; 14.62 per cent, −65+100 mesh; 12.47 per cent, −100+150 mesh; 12.71 per cent, −150+200 mesh; and 48.80 per cent, −200 mesh. Apparently zinc ores are ground less finely than other ores, which may explain, in part, the lower recoveries of metal obtained by flotation in the treatment of this class of ore.

Alkalinity.—Alkalinity was reported in terms of pH units as follows: Lead circuit, 5 plants treating 126,548 tons; average pH, 8.74. Zinc circuit, 17 plants treating 573,463 tons; average pH, 8.82.

GOLD AND SILVER ORES

Of the total of about 3,844,000 tons of gold and silver ores produced in 1930, more than 3,272,000 tons were treated at gold and silver mills using amalgamation or cyanidation. A large part of the remainder was sent to smelters as fluxing material; and the balance (283,053 tons), was treated at concentration plants. Most of the ore concentrated was treated by flotation. Many of the plants treating gold and silver ores use flotation in conjunction with amalgamation or cyanidation.

TABLE 16.—*Reagent consumption in the treatment of gold and silver ores*

[Twenty-six plants treating 219,204 tons of ore]

Reagents	Plants using	Ore treated, tons	Consumption of reagents, pounds	
			Total	Per ton
I. Frothers:				
Pine oils	25	204, 314	19, 784	0. 097
Cresylic acid	5	67, 391	4, 417	. 066
Orthotoluidine	1	220	35	. 159
Total frothers	26	219, 204	24, 236	. 111
II. Collectors:				
Distillation products—				
Coal-tar creosotes	5	59, 270	2, 738	. 046
Wood-tar creosotes	1	665	125	. 188
Petroleum products	2	11, 982	4, 955	. 414
Water-gas tars	1	9, 766	2, 440	. 250
Total	8	71, 917	10, 258	. 143
Synthetic products—				
Ethyl xanthates	21	162, 531	19, 449	. 120
Amyl xanthates	9	115, 831	9, 772	. 084
Dicresol-dithiophosphoric acid	3	119, 416	5, 868	. 049
Sodium dicresol-dithiophosphate	1	1, 924	200	. 104
Total	26	219, 204	35, 289	. 161
Total collectors	26	219, 204	45, 547	. 208
III. Acids[1] and alkalies:				
Alkalies—				
Sodium carbonate	5	19, 859	29, 230	1. 472
Lime	3	46, 869	24, 170	. 515
Total	8	66, 728	53, 400	. 800
IV. Other inorganic reagents:				
Sulphidizing—sodium sulphide	8	85, 921	53, 653	. 624
Activating—copper sulphate	2	80, 944	8, 085	. 100
Depressing—				
Cyanides	1	10, 193	2, 875	. 282
Sodium silicate	1	10, 193	6, 618	. 649
Zinc sulphate	1	10, 193	9, 830	. 964
Total	1	10, 193	19, 323	1. 896
Total reagents	26	219, 204	204, 244	. 932

[1] No acids consumed in 1930.

Flotation reagents.—The consumption data on flotation reagents used in the treatment of gold and silver ores are summarized in Table 16. In 1930, as in 1929, the ores included in this group were valuable chiefly for their gold and silver content, but probably most of the ores contained one or more base metals of which the assay was too low to allow the material to be classified under the base-metal group. Thus, a large variety of ores, both sulphide and oxidized, is included in this group. It is not possible to classify the material by its mineralogical content, because insufficient data were obtained. Owing to the large variety of ores represented, one would not expect that any uniformity would be expressed in the selection of the reagents used in the different plants, and no generalized statements can be made regarding the applicability of any particular reagent. One of the more important changes evidenced by a comparison of Table 16 with similar data for 1929 is the increased use of amyl xanthates and sodium sulphide. Most of the copper sulphate reported was used by one plant as a pyrite activator, and the balance was used as a zinc activator. All of the depressing reagents were used by one plant treating a gold ore containing minor quantities of galena and sphalerite and making both lead concentrates and zinc concentrates.

TABLE 17.—*Metallurgical data on the treatment of gold and silver ores in 1930*

TWENTY PLANTS (18 STRAIGHT FLOTATION AND 2 COMBINED GRAVITY AND FLOTATION) NOT USING AMALGAMATION OR CYANIDATION

Contents of mill feed and products

	Tons	Gold, ounces	Silver, ounces	Copper, pounds	Lead, pounds	Zinc, pounds
Mill feed	153, 038	38, 409. 47	921, 300	65, 450	35, 480	
All concentrates	8, 436	28, 907. 73	778, 954	42, 705	28, 060	

Assay of mill feed and products

	Gold, ounces per ton	Silver, ounces per ton	Copper, per cent	Lead, per cent	Zinc, per cent
Mill feed	0. 251	6. 020	0. 0214	0. 0116	
All concentrates	3. 427	92. 337	. 2531	. 1663	

Recoveries (per cent)

	Ratio of concentration	Gold	Silver	Copper	Lead	Zinc
All concentrates	18. 14:1	75. 26	84. 55	65. 25	79. 09	

SIX PLANTS USING FLOTATION AND AMALGAMATION OR CYANIDATION

Contents of mill feed and products

	Tons	Gold, ounces	Silver, ounces	Copper, pounds	Lead, pounds	Zinc, pounds
Mill feed	66, 166	28, 747. 92	301, 353	47, 298	564, 325	290, 576
All concentrates	2, 581	9, 576. 77	55, 603	32, 085	305, 499	207, 642
All bullion		18, 029. 25	211, 632			
All products		27, 606. 02	267, 235	32, 085	305, 499	207, 642

Assay of mill feed and products

	Gold, ounces per ton	Silver, ounces per ton	Copper, per cent	Lead, per cent	Zinc, per cent
Mill feed	0. 4345	4. 5545	0. 0357	0. 4264	0. 2196
All concentrates	3. 7105	21. 5432	. 6216	5. 9182	4. 0225

Recoveries (per cent)

	Ratio of concentration	Gold	Silver	Copper	Lead	Zinc
All concentrates	25. 64:1	33. 31	18. 45	67. 84	54. 14	71. 46
All bullion		62. 71	70. 23			
All products		96. 03	88. 68	67. 84	54. 14	71. 46

Metallurgical results.—Fairly complete metallurgical data were available for all 26 of the plants included in this group. Some of the plants used a combination of flotation and amalgamation or cyanidation; the others were straight concentration plants not using amalgamation or cyanidation. The data are given in Table 17. It should be pointed out that all the ore included in this group would be classified as "complex," as part, at least, of the gold is intimately associated with base-metal minerals and should not be confused with the so-called dry and siliceous or free-milling gold ores, which are treated easily by amalgamation or cyanidation. From the first part of Table 17, showing the results obtained by flotation at 20 plants, it is obvious that improvement in the recovery of gold would be very desirable. This low recovery may be due partly to the low recovery of the base-metal minerals, as indicated by the copper and lead recoveries, and partly to free gold, which was either too coarse to float or had a "rusty" or tarnished surface, thus decreasing its flotability. From the second part of Table 17 it appears that neither flotation, amalgamation, nor cyanidation, when used alone, will give satisfactory gold recoveries but that the combination gives excellent results.

Screen analysis.—Of the 26 plants reporting, screen analyses were given by 8 plants treating 172,292 tons of ore. The calculated average was 1.44 per cent + 65 mesh, 7.81 per cent − 65 + 100 mesh, 11.64 per cent − 100 + 150 mesh, 20.33 per cent − 150 + 200 mesh, and 58.78 per cent − 200 mesh. No comparative figures are available for 1929.

Alkalinity.—The alkalinity of the flotation circuit was reported by six plants treating 124,361 tons of ore. The average pH was 7.0.

SUMMARY OF REAGENT CONSUMPTION

TABLE 18.—*Summary of consumption of reagents by classes of ores*

[Pounds of reagents per ton of ore treated]

	Copper	Copper-iron	Copper (native)	Copper-lead	Lead	Lead-zinc	Zinc	Gold-silver
Ore treated..............tons..	34, 050, 473	447, 940	2, 346, 070	283, 260	5, 211, 890	3, 195, 948	1, 504, 237	219, 204
Number of plants..............	39	2	5	6	38	70	44	26
Reagents per ton:								
I. Frothers......pound..	0. 154	0. 078	0. 120	0. 141	0. 145	0. 190	0. 149	0. 111
II. Collectors—								
Distillation..do....	. 052	. 006	. 011	. 151	. 021	. 327	. 132	. 143
Synthetic...do....	. 082	. 295	. 085	. 093	. 143	. 284	. 194	. 161
III. Acids and alkalies—								
Acids....pounds..	....	26. 456	....	....	5. 864	....	....	....
Alkalies.....do....	4. 154	7. 728	. 282	. 407	. 335	2. 532	1. 791	. 800
IV. Other inorganic reagents—								
Sulphidizing........pounds..	. 039	....	....	3. 560	2. 385	. 549	. 012	. 624
Activating..do....	....	. 664	....	....	. 104	1. 051	1. 017	. 100
Depressing..do....	. 038	....	....	. 304	. 126	1. 243	. 242	1. 896
Miscellaneous.........pound..	....	....	....	....	....	. 171	. 020	....
Total reagents......pounds..	4. 410	35. 053	. 293	. 468	. 889	4. 625	2. 934	. 932

FLOTATION OF OTHER ORES

The foregoing sections of this paper have dealt with the use of flotation in the concentration of copper, native copper, copper-iron, lead, copper-lead, lead-zinc, and zinc ores. Flotation also has been applied successfully in the treatment of many other types of ore, both metallic and nonmetallic. The details of these flotation operations in many cases are not available for publication.

Molybdenum.—During 1930 two plants employed froth flotation in the treatment of molybdenum ore. The plants treated 426,370 tons of molybdenite ore, recovering 88.60 per cent of the contained molybdenum in concentrates assaying 85.53 per cent molybdenum sulphide. The reagents used were the same at both plants and consisted of 0.230 pound of pine oils and 0.008 pound of sodium cyanide per ton of ore treated. The ore contains a small quantity of pyrite, which is depressed into the tailings. The flotation reagents consumed at these plants are not included in Table 2, pages 751 and 752.

Manganese.—The use of sodium oleate and pine oils in the flotation of rhodochrosite on a laboratory scale was reported as early as 1928. A western mining company reported a commercial-scale test of the process in 1930, in which several thousand tons of rhodochrosite ore containing minor quantities of galena and sphalerite were treated. A bulk sulphide concentrate was made prior to the manganese flotation. No detailed report was received giving the results of the test. Preliminary laboratory experimental work has also demonstrated the commercial possibilities of the flotation of certain oxidized manganese ores containing chiefly pyrolusite.

The following paragraph is taken from Mineral Industry, 1930, page 686.

> Manganese carbonate and oxide have yielded to research. Ore from the Emma mine at Butte is floated at Anaconda, where the sphalerite is taken off first, followed by the rhodochrosite. For the latter step the reagents are soap, soda, and sodium silicate, and concentrates assay 38.5 to 40 per cent manganese and 5 to 7 per cent silica, with an extraction of 95 per cent. Subsequent nodulizing of these concentrates raises the grade to 60 or 62 per cent manganese. A plant is under construction for commercial flotation of pyrolusite in Cuba, and manganiferous iron ores of Lake Superior have been floated in the laboratory.

The following statement regarding the flotation of pyrolusite is taken from Mineral Industry, 1929, page 730.

> On oxide ores or pyrolusite the commercial operation has not arrived, but there is ample laboratory evidence that it can be done. A typical test on ore containing 25.3 per cent manganese and 54 per cent insoluble gave concentrates with 56 per cent manganese and 4 per cent insoluble and an extraction of over 96 per cent. Reagents used per ton were 0.12 pound of pine oil, 0.21 pound of of oleic acid, 2.5 pounds of sodium silicate, and 2.5 pounds of sodium carbonate. Heating the pulp gives improved results. The presence of large amounts of slime, either iron or clay, lowers the grade of the concentrates.

Barium (*barite*).—One company operating a flotation plant in California in 1930 treated old tailings from a silver mine containing about 25 per cent barium sulphate. Flotation concentrates containing about 94 per cent barium sulphate were marketed. The flotation reagents used are patented but were not reported by the technical press. For further details regarding this operation see reference 101, page 784. Various reagents have been reported in the laboratory-scale flotation treatment of barite ores, including pine oils, oleic acid, sodium carbonate, and sodium silicate. United States Patents 1662633 and 1662634 specify the use of certain substances containing soap and "cottonseed oil pitch" as collecting reagents in the flotation of barite.

Phosphate.—Flotation has been used commercially in the treatment of phosphate sands in Florida. At present the flotation operation is supplementary, slimes from the usual log-washer plants being treated. Flotation testing on a laboratory scale has indicated that the most useful reagents are pine oils, sodium oleate, sodium silicate, sodium carbonate, and sodium sulphide.

Fluorspar.—Flotation has been applied commercially to the concentration of fluorspar ores since March 18, 1929, by the Franklin Fluorspar Co., at Rosiclare, Ill. During 1930 more than 16,000 tons of fluorspar ore were treated in the new flotation plant, yielding 6,173 tons of grade 1 concentrates and 823 tons of grade 2 concentrates. A small quantity of galena concentrates was also recovered. The chief flotation reagents used were cresylic acid, dicresol dithiophosphoric acid (in the galena circuit), and oleic acid and cresylic acid (in the fluorspar circuit). For a more detailed discussion of the operations of this plant see Davis, Hubert W., Fluorspar and Cryolite in 1930: Mineral Resources, 1930, Part II, page 25.

Sulphur and graphite.—Flotation has been applied commercially to the concentration of elemental sulphur and crystalline graphite ores, but the plants were not operated during 1930.

Other economic minerals.—The above sections have dealt with commercial applications of flotation. Experimental work on a laboratory scale has given encouraging results in the flotation of coal, quartz, hematite, siderite, mica, limestone, and bauxite.

BIBLIOGRAPHY

The following annotated bibliography has been prepared from flotation literature published during the calendar year 1930. Many of the annotations were taken directly from Chemical Abstracts (published by the American Chemical Society, Easton, Pa.), the general use of which the authors wish to acknowledge. Other annotations were taken directly from the original publications. An effort has been made to abstract all articles dealing with flotation published in 1930, and no article has intentionally been omitted.

For convenience to the user, the articles have been classified by subject matter into general groups such as copper ores, lead ores, lead-zinc ores, etc., and they are arranged under each group alphabetically by authors. Naturally, many articles would fall into two or more groups, and to avoid duplications a cross reference by numbers is given at the end of each group. A list is also given of the United States and Canadian patents dealing with flotation that were granted in 1930.

The following abbreviations were used:

Serial	Abbreviation
American Association for the Advancement of Science, New York.	Science.
American Cyanamid Co., Technical Department, New York.	Am. Cyan. Co. Tech. Paper.
American Institute of Mining and Metallurgical Engineers, New York.	
Transactions	Trans. Am. Inst. Min. and Met. Eng.
Technical Publication	Am. Inst. Min. and Met. Eng., Tech. Pub.
Milling Methods	Am. Inst. Min. and Met. Eng. (Milling Methods).
Mining and Metallurgy	Min. and Met.
Annales des Mines de Roumaine, Bucharest, Roumania.	Ann. Mines Roumaine.
Boletin Minero de la Sociedad Nacional de Mineria, Santiago, Chile.	Bol. Minero Soc. Nac. Min.
Bulletin of the Chilean Institution of Mining and Metallurgy, Santiago, Chile.	Chile Inst. Min. and Met., Bull.
Bulletin of the Institution of Mining and Metallurgy, London.	Inst. Min. and Met. (London), Bull.
Canada Department of Mines, Mines Branch, Ottawa.	Canadian Dept. Mines, Min. Branch.
Canadian Institute of Mining and Metallurgy, Bulletin, Montreal.	Canadian Inst. Min. and Met., Bull.
Canadian Mining Journal, Gardenvale, Quebec.	Canadian Min. Jour.
Chemical Engineering and Mining Review, Melbourne, Australia.	Chem. Eng. and Min. Rev.
Chemiker Zeitung, Cothen, Germany	Chem. Ztg.
Engineering and Mining Journal, New York	Eng. and Min. Jour.

Serial	Abbreviation
Kolloid Zeitschrift, Dresden-Blasewitz, Germany.	Kolloid Ztschr.
Metallbörse, Berlin, Germany	Metallbörse.
Metall und Erz, Muhlweg, Germany	Metall u. Erz.
Mineralnoe Suire, Moscow, U. S. S. R.	Miner. Suire.
Mining Congress Journal, Washington	Min. Cong. Jour.
Mining Journal (Arizona), Phoenix	Arizona Min. Jour.
Mining Journal, London	Min. Jour. (London).
Mining Magazine, London	Min. Mag. (London).
Mountain States Mineral Age, Denver	Mt. States Min. Age.
Proceedings of the Australasian Institute of Mining and Metallurgy, Melbourne, Australia.	Australasian Inst. Min. and Met., Proc.
Rassegna Mineraria e Metallurgica Italiana, Rome, Italy.	Rass. Min. e Met. Italiana.
Revista Financiera Salitre y Minas, Santiago, Chile.	Rev. Fin. Min.
Revista Minera Metalurgica y de Ingenieria, Madrid, Spain.	Revista Minera.
Revue de Metallurgie, Paris, France	Rev. Met.
School of Mines of Western Australia, Bulletin, Kalgoorlie.	School of Mines of Western Australia, Bull.
South African Mining and Engineering Journal, Johannesburg.	South African Min. and Eng. Jour.
Teknish Tidskrift, Stockholm, Sweden	Teknish Tidskrift.
Tzvetnuie Metallui, Moscow, U. S. S. R.	Tzvetnuie Metallui.
United States Bureau of Mines, Department of Commerce, Washington.	
Information Circular	Inf. Circ., Bureau of Mines.
Report of Investigations	Rept. of Investigations, Bureau of Mines.
Technical Paper	Tech. Paper, Bureau of Mines.
University of Utah, Department of Mining and Metallurgical Research Technical Paper, Salt Lake City.	Univ. of Utah, Tech. Paper.
Wochenschrift für die Fortschritte der reinen und der angewandten Naturwissenschaften, Berlin, Germany.	Naturwissen.

COPPER ORES

1. Alexeyev, L. M., and Zubaryov, S. N. Ore concentration at Lenin and Shaumyan group of Zangezur deposits. Tzvetnuie Metallui, No. 6, 1930, pp. 873–902.

Description of flotation practice developed in the treatment of copper and copper-zinc ores from mines located near the Persian border of Russia. Flow sheets and metallurgical data are given. (Russian.)

2. American Cyanamid Co. Flotation of metallic copper. Tech. Paper 15, 1930, 5 pp.

A description of Michigan milling practice on native copper ores. Reagents studied and metallurgical results obtained are given.

3. Anderson, A. K., and Godard, J. S. The selective flotation of copper-zinc ore from the Abana mine, Dupuy, Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 8.

Ore consists of copper, zinc, and iron sulphides intimately associated. Flotation gives very good recoveries of both copper and zinc in concentrates of good grade. Gold and silver are largely associated with the copper minerals.

4. Baker, L. M. Concentrating plant of the United Verde Copper Co. Min. Cong. Jour., vol. 16, 1930, p. 363.

Description of plant with flow sheet and metallurgical data.

5. Benedict, C. Harry. Methods and costs of treatment at the Calumet & Hecla reclamation plant. Inf. Circ. 6357, Bureau of Mines, 1930, 11 pp.

Native copper is recovered. Tailings dumps are reworked by leaching and flotation to recover 90 per cent of the copper.

6. ———. Milling method and cost at the Conglomerate Mill of the Calumet & Hecla Consolidated Copper Co. Inf. Circ. 6364, Bureau of Mines, 1930, 22 pp.

Native copper occurs in conglomerate of felsite, quartz porphyry, and feldspar porphyry. Complete liberation of values is impossible. Sands are leached and slimes floated. Flotation reagents are sodium xanthate, lime, and pine oil. Flow sheets and metallurgical and cost data are given.

7. Burn, A. K. The flotation of chalcopyrite in sea water. Chile Inst. Min. and Met., Bull. 314, 1930, 10 pp.

Mill at Tocopill, Chile, is described. Flotation concentrates are recleaned twice. Final concentrates contain 27.5 per cent copper. Alkalinity of circuit is 8.0 pH. Tests indicate that the use of sea water improves the flotation of coarse concentrates but has a deleterious effect on the frothing properties of cresylic compounds.

8. Canadian Mining Journal. Increasing the gold recovery from copper ores. Vol. 51, 1930, p. 676.

Gold content of copper ores usually so low that its recovery is given little consideration. The Rare and Precious Metals Experiment Station of the U. S. Bureau of Mines, in cooperation with the University of Nevada, Reno, Nev., has made a study of gold and silver occurrences in a particular ore where the copper is present largely as chalcopyrite, associated with pyrite, pyrrhotite, magnetite, and the usual gangue. Low recovery of the gold is due to the solution circuit carrying lime to almost the point of saturation.

9. ———. The International Nickel Co. of Canada (Ltd.). Vol. 51, 1930, p. 1034.

Brief outline of the development of the Frood property. A brief description of the mill by W. T. MacDonald is included.

10. ———. Metallization and floating copper ores. Vol. 51, 1930, p. 676.

Note taken from the June issue of The Mining Magazine (London): Oxidized copper ores are heated in the presence of carbon and sodium chloride to produce finely divided metallic copper which is then floated.

11. Davidovich, B. A., and Lubman, N. M. Flotation of oxidized copper ores. Tzvetnuie Metallui, No. 7, 1930, pp. 977–992.

Results of flotation tests on sandstone copper ores of Orenburg region. Mineralogical, petrographic, and chemical analyses of ores are given. Flotation tests were made with and without sulphidization of the oxidized copper minerals. (Russian.)

12. Engineering and Mining Journal. Union Minière, largest of copper producers. Vol. 130, 1930, p. 506.

Combination gravity and flotation concentration used to produce concentrates assaying from 29.1 to 33.5 per cent of copper from mill feed assaying 6 to 10 per cent of copper. General description of company operations is given.

13. Foster, L. E. New Cornelia completes mill enlargement. Arizona Min. Jour., vol. 14, 1930, pp. 7, 30.

Describes changes made in intermediate and fine crushing departments and flotation units at the mill of the Calumet and Arizona Mining Co. at Ajo, Ariz.

14. Gardner, R. Duncan. Milling methods and costs at the Harmony mines, Baker, Idaho. Inf. Circ. 6285, Bureau of Mines, 1930, 18 pp.

Chalcopyrite is the chief copper mineral. Some chalcocite and bornite are present. Pyrite is present with the chalcopyrite. Ore oxidizes readily, and best results are obtained on freshly broken ore. Quantity of reagents added and conditioning periods must be controlled very closely. Flow sheet and metallurgical and cost data are given.

15. Garms, W. I. Concentrator methods and costs of the Hayden plant of the Nevada Consolidated Copper Co., Arizona. Inf. Circ. 6241, Bureau of Mines, 1930, 25 pp.

Ore consists of chalcocite and pyrite disseminated through quartz-sericite schist. Mill feed contains 1.25 per cent copper and concentrates 19.8 per cent copper with 87.8 per cent recovery. Flow sheets and metallurgical and cost data are given.

16. Gaudin, A. M., and Anderson, Arvid E. Flotation fundamentals. Pt. V. Flotability of pure minerals and synthetic mixtures of pure minerals under standardized conditions. Some attempts at reducing the cost of floating copper carbonate ores. Univ. of Utah, Tech. Paper 9, 1930, 25 pp.

Lead salts and amyl xanthate reduce the cost of flotation of carbonate copper ores about one-third. Under certain conditions zinc nitrate was found to be of

value as an activator. Data pertaining to the flotation of malachite and of cerussite in flotation circuits of various alkalinities and with various reagents are presented.

17. Godard, J. S. Experimental tests on a copper-gold ore from Oxford Lake, Northern Manitoba. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 62.

Ore consists of chalcopyrite carrying gold and silver, pyrite, pyrrhotite, and a trace of arsenopyrite in a quartz gangue. Iron concentrates are high in gold when selective flotation is used without previous amalgamation. If amalgamation is followed by flotation of the chalcopyrite this condition does not obtain, indicating that the gold is free and does not float with the chalcopyrite. Silver is not recovered by amalgamation.

18. ———. Concentration of a copper-molybdenum ore from the Golconda mine, Keremeos, British Columbia. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 24.

Molybdenum present as very fine-grained molybdenite often associated with pyrite and chalcopyrite in a siliceous gangue. Results of selective flotation tests for the production of molybdenum concentrates and copper concentrates are given.

19. Handy, R. S. Milling methods and costs at the northern Idaho mills of the Bunker Hill & Sullivan Mining & Concentrating Co. Inf. Circ. 6314, Bureau of Mines, 1930, 53 pp.

Methods and costs of milling at five concentrators given. Two of the plants treated lead ores, two treated lead-zinc ores, and one treated copper-lead ores. Flow sheets and metallurgical and cost data are given. Flotation is used at all mills. One mill uses combined flotation and gravity concentration.

20. Huttl, J. B. United Verde Extension's new concentrator at Clemenceau. Eng. and Min. Jour., vol. 130, 1930, p. 317.

Flow sheet and discussion of design of concentrator are given.

21. Kuzell, C. R., and Barker, L. M. Milling methods and costs at the concentrator of the United Verde Copper Co., Clarkdale, Ariz. Inf. Circ. 6343, Bureau of Mines, 1930, 28 pp.

Ore contains chalcopyrite, pyrite, marmatite, schist, quartz, hydrated iron oxides, and calcite. Minor amounts of covellite and bornite are present. Detailed flow sheets aud metallurgical and cost data for September, 1929, are given.

22. Low, Bola. A nickel-copper deposit in New Brunswick, Canada. Eng. and Min. Jour., vol. 130, 1930, p. 115.

Leaching and flotation are compared. Copper, nickel, and iron occur as sulphides. Tables show flotation tests and estimated recoveries. It is possible to produce copper concentrates, nickel concentrates, and iron concentrates.

23. Maxwell, W. B. The Anyox concentrator of the Granby Co. Eng. and Min. Jour., vol. 129, 1930, p. 343.

Copper ore occurs as chalcopyrite intimately associated with pyrite and pyrrhotite in a silicified greenstone gangue and carries small amounts of gold and silver. Equipment and operation of the flotation plant are described, and flow sheets and metallurgical data are given. Oxidation, with resulting soluble salts, has a detrimental effect on flotation.

24. ———. Copper concentration as applied to Canadian ores. Canadian Min. Jour., vol. 51, 1930, p. 367.

Canadian copper ores, some of which are complex and most of which contain gold and silver, are described. Milling methods at the Britannia, Granby, Anyox, Allenby, and Noranda concentrators are described. Flotation reagents used are listed, and metallurgical data are given.

25. McDonald, William T. The Inco enterprises. Selective flotation mill at Copper Cliff. Eng. and Min. Jour., vol. 130, 1930, pp. 465–473.

Ore treated contains 4.5 per cent copper and 2.25 per cent nickel; both metals occur as sulphides. Description of mill, flow sheets, and complete metallurgical data are given.

26. McGregor, A. G. The Roan Antelope Copper mine. Min. Mag. (London), vol. 43, 1930, pp. 270–276.

27. ———. The Roan Antelope mill and smelter. South African Min. and Eng. Jour., vol. 41, Pt. II, 1930, p. 373.

Ore, a dense, compact, dolomitic argillite carrying finely disseminated chalcocite and bornite, is treated by flotation.

28. McLachlan, C. G. Twelve months' milling at Noranda. Canadian Inst. Min. and Met., Bull. 214, 1930, p. 237.

Ore contains about 3 per cent copper, 0.15 ounce of gold per ton, and 51 per cent iron. The copper is present as chalcopyrite, the gold as telluride, and the iron as pyrite and pyrrhotite. Differential flotation is used. Mill results are compared with laboratory results.

29. Melchett, —. International Nickel Co. Min. Jour. (London), vol. 170, 1930, p. 743.

Brief description of the various concentrators and refineries of this company in Canada.

30. Mining and Metallurgy. The New Cornelia mill at Ajo, Ariz. Vol. 11, 1930, p. 437.

Capacity increased from 5,000 tons in 1924 to 15,000 tons in 1930. Recovery of copper increased from 89 to 93 per cent.

31. Murray, R. M. Metallurgical operations at Mount Lyell, Tasmania. Eng. and Min. Jour., vol. 130, 1930, p. 12.

Originally a gold property. Now considered a large copper deposit. Flow sheets are given for the all-flotation plant, also for the sintering, blast-furnace, and refining operations.

32. Naumov, V. A. Experimental concentration of Jezkazgan oxidized copper ore. Tzvetnuie Metallui, No. 7, 1930, pp. 992–1011.

Experimental work includes flotation with preliminary sulphidization in the ball mill, also sulphidization in the flotation circuit. Sodium silicate was tried. (Russian.)

33. Parsons, C. S., and Anderson, A. K. The concentration of the copper sulphide ores of the Hollinger-Kamiskotia property. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 79.

Ore consists of a hard, dense pyrite carrying finely disseminated copper sulphides. Small amounts of zinc and silver, with a trace of nickel and gold, are associated with the copper sulphides. Flotation is used to produce a high-grade copper concentrate. Lime, xanthate, "TT mixture," and pine oil are used.

34. Parsons, C. S., and Godard, J. S. The concentration of the copper-zinc ore from the Amulet mine, Rouyn, Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 37.

Ore consists of pyrite, chalcopyrite, pyrrhotite, and sphalerite containing gold and silver. Flotation tests produced satisfactory results. Control of reagents and conditioning periods are important.

35. ———. Flotation of copper-zinc ore from the Amulet mine, Rouyn district, Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 44.

Satisfactory flotation results were not obtained. The zinc could not be depressed satisfactorily without depressing copper; and the zinc tailings, as a result, ran high in zinc.

36. ———. Concentration of a complex copper-zinc ore from the Sherritt-Gordon mine, Cold Lake, Manitoba. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 26.

Complex copper-zinc-iron sulphide ore containing some gold and silver. Results of flotation tests are given. This method of treatment is satisfactory but requires careful control of alkalinity and quantity of zinc sulphate added.

37. ———. The concentration of the copper-zinc-pyrite ore of the Aldermac mine, Aldermac, Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, p. 65.

Selective flotation used to produce copper concentrates, zinc concentrates, and iron concentrates. Copper quite easily floated. Recovery of zinc and iron not satisfactory due to oxidation of the heavy sulphides during grinding.

38. Rose, E. H., and Cramer, W. B. Milling methods and costs at the Nacozari concentrator of the Phelps Dodge Corporation, Nacozari, Sonora, Mexico. Inf. Circ. 6358, Bureau of Mines, 1930, 38 pp.

Copper occurs chiefly as chalcopyrite accompanied by small quantities of chalcocite, covellite, and bornite. Traces of tenorite and cuprite are present. Ratio of pyrite to chalcopyrite is 2: 1. Some sphalerite, magnetite, and hematite are present. A small amount of silver is associated with the chalcopyrite. Gangue in upper levels of mine is hard latitite breccia; in lower levels it is hard andesite breccia. These flows are cut by intrusions of monzonite, diorite, and quartz porphyry. Flow sheets and detailed metallurgical and cost data are given.

39. Rose, J. H., and McNabb, J. C. Milling methods and costs at the concentrator of the Magma Copper Co., Superior, Ariz. Inf. Circ. 6319, Bureau of Mines, 1930, 20 pp.

The chief minerals are bornite, chalcopyrite, and pyrite, each carrying gold and silver. Ore deposit is massive in an altered silicified diabase with a quartz

gangue. Since the ore oxidizes readily, flotation is difficult and tailing losses are high. Method of treatment, flow sheets, and cost and metallurgical data are given in detail.

40. Rosov, B. I., and Sukhovolskaya, S. D. Flotation of copper ores containing oxygen. Tzvetnuie Metallui, No. 2, 1930, p. 208.

Results given of experimental work on flotation of malachite, hydrogen-ion concentration, treatment with sodium sulphide, and degree of grinding of ore. (Russian.)

41. Salisbury, J. C. The United Verde Extension concentrator. Arizona Min. Jour., vol. 14, 1930, p. 10.

Description of new flotation plant treating low-grade siliceous sulphide copper ores.

42. Sheridan, L. M. The Inco enterprises. Features of design of mill and smelter. Eng. and Min. Jour., vol. 130, 1930, p. 460.

Ore treated assays 4.5 per cent copper and 2.25 per cent nickel, both as sulphides. Engineering problems involved in the design of the smelter and concentrator at Copper Cliff.

43. ———. The new smelter and concentrator of the International Nickel Co. at Copper Cliff, Ontario. Canadian Min. Jour., vol. 13, 1930, p. 682.

Ore treated assays 4.5 per cent copper and 2.25 per cent nickel; both metals occur in the ore as sulphides. Sulphides floated. Rough separation of copper and nickel made by selective flotation.

44. Stokes, R. O. A new concentrator at Rio Tinto. Min. Mag. (London), vol. 43, 1930, p. 329.

Describes plant for concentration of cupriferous sulphides.

45. Sweeney, E. L. Treatment of oxidized copper ores. Arizona Min. Jour., vol. 13, 1930, p. 9.

In the past oxidized copper ores were treated only by direct smelting or leaching. Flotation opens up new reserves too low-grade for direct smelting.

46. Taylor, H. R. The Allenby concentrator of the Granby Co. Eng. and Min. Jour., vol. 129, 1930, p. 175.

Ore contains copper sulphides and a small amount of gold and silver. Concentration practice of the Granby Consolidated Mining Co. is outlined. Flow sheet and metallurgical data are given.

47. Tye, A. T. Milling methods and costs at the concentrator of the Cananea Consolidated Copper Co., Cananea, Sonora, Mexico. Inf. Circ. 6261, Bureau of Mines, 1930, 21 pp.

Copper ore consists of bornite, chalcopyrite, tetrahedrite, and pyrite, in a gangue of silicified lime and garnet. Description of plant, flow sheet, and metallurgical and cost data are given in detail.

48. Young, George J. Improvement at New Cornelia, I. Eng. and Min. Jour., vol. 129, 1930, p. 608.

Copper sulphide and carbonate ores are treated. Details of present practice and recent plant improvements are given. Coarse and fine crushing sections are discussed in detail.

49. ———. Improvements at New Cornelia, II. Eng. and Min. Jour., vol. 130, 1930, p. 28.

Mill for concentrating sulphide ores and leaching plant are discussed.

50. ———. Another porphyry copper in the making. Eng. and Min. Jour., vol. 130, 1930, p. 522.

Developments of the Bagdad Copper property near Hillside, Ariz., prospects, reserves, details of pilot-plant construction and operation, and flow sheets of the concentrating mill and experimental hydrometallurgical plant are given. Ore contains chiefly sulphide copper minerals with some oxide copper minerals. Ore treated contains approximately 1.5 per cent copper.

See also references 55, 59, 69, 73, 77, 80, 87, 88, 91, 92, 111, 112, 114, 115, 116, 123, 136, 143, 144, 145, 146, 147, and 148.

For patents see references 162, 163, 167, 169, 171, 172, 173, 180, 181, 183, 187, and 189.

LEAD ORES

51. Keiser, H. D. Mine La Motte: A historic lead property in southeast Missouri. Eng. and Min. Jour., vol. 130, 1930, pp. 110–114.

History and geology of property. Ore is galena which occurs both disseminated and massive in a lime-cemented sand. A flow sheet of the flotation plant is given.

52. Monks, Augustus J., and Weiss, Norman L. Concentration of oxidized lead ores at San Diego mill, Cia. Minera Asarco. Min. and Met., vol. 11, 1930, pp. 455–458.

Of the lead in the mill feed, 60 per cent occurs as cerussite, 20 per cent as galena, 10 per cent as anglesite, and 10 per cent as miscellaneous lead minerals. Flotation circuit is described in detail.

53. Parsons, C. S. Concentration of a lead ore from the Ogema mine, Dorion, Ontario. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 5-6.

Lead occurs in the form of galena, part of which is finely disseminated. Most of gangue is calcite. Traces of gold and silver are present. Flotation proved most satisfactory.

54. Patzschke, —. Ore dressing at German Scharley lead mines. Metall u. Erz, vol. 27, 1930, pp. 113–120.

Gives complete description of ore-dressing methods at these mines, including metallurgical and cost data.

55. Wigton, G. H. Milling methods and costs at the concentrator of the Chief Consolidated Mining Co., Eureka, Utah. Inf. Circ. 6320, Bureau of Mines, 1930, 18 pp.

Ore treated occurs as replacement in limestone and contains cerussite, galena, anglesite, native silver, native gold, cerargyrite, argentojarosite, malachite, and azurite; quartz is the principal gangue mineral. Limestone and small amounts of hematite are also present. Method of treatment, flow sheets of the various stages, and cost and metallurgical data are given.

See also references 19, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 88, 91, 116, 117, 120, 121, 123, 124, and 132.

For patents see references 172 and 183.

ZINC ORES

56. Gaudin, A. M., Haynes, C. B., and Haas, E. C. Flotation fundamentals. Pt. IV. Flotability of pure minerals and synthetic mixtures of pure minerals under standardized conditions. Sphalerite. Univ. of Utah, Tech. Paper 7, 1930, 40 pp.

Study of flotability of pure sphalerite under varying conditions. Various collecting, activating, depressing, frothing, and conditioning reagents were studied.

57. Kraeber, Ludwig. Investigation on the influence of the iron content of zinc blendes on their flotability. Mitteilungen Kaiser-Wilhelm Institut Eisenforschung Dusseldorf, vol. 12, 1930, pp. 343–352.

Mechanically agitated and pneumatic cells were used. Each sample of blende gave a definite pH to the water, regardless of whether the water was originally slightly alkaline or acid. The higher the iron content the lower the pH. Maximum recovery was obtained at a pH between 6 and 7. Very small quantities of copper sulphate speed up the rate of recovery. The presence of foreign material and the pretreatment are more important than the iron content in affecting flotability.

58. Strachan, C. B. Milling methods of the American Zinc Co. of Tennessee, Mascot, Tenn. Inf. Circ. 6379, Bureau of Mines, 1930, 12 pp.

Ore consists of sphalerite, dolomite, calcite, pyrite, quartz, and a small quantity of greenockite. Treatment consists of combined gravity and flotation concentration.

See also references 1, 3, 19, 21, 33, 34, 35, 36, 37, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 87, 116 117, 121, and 132.

For patents see references 167, 169, and 183.

LEAD-ZINC ORES

59. Allen, Glenn L. Milling practice at San Francisco Mines of Mexico (Ltd.). Am. Inst. Min. and Met. Eng., Tech. Pub. 371, 1930, 24 pp.

The ore is a complex lead-zinc-iron ore carrying some copper, silver, and gold. Description of mill and methods of concentrating. Combined gravity and flotation concentration is used. Flow sheets and metallurgical and cost data are given.

60. Anderson, A. K., and Parsons, C. S. Concentration of lead-zinc ore from Larchwood, Ontario. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 48–57.

Ore consists of massive sulphides of iron and zinc with galena finely disseminated through the sulphides. Some graphite is present. By flotation only fair recoveries are possible. Sodium carbonate was used to neutralize the greater part of the acidity, followed by a brief contact with lime before flotation.

61. Berl, E., and Schmitt, B. Wetting phenomena with blende and lead glance. (Über Benetzungsphänomene an Zinkblende und Bleiglanz.) Kolloid Ztschr., vol. 52, 1930, pp. 333–341. See also brief translated abstract in Chem. and Ind., vol. 49, 1930, p. 1114.

Wetting of materials such as blende and galena by liquids is dependent largely upon the presence of surface films of oxidation products. Effect of alkali hydroxides, cyanides, and xanthates on wettability of blende and galena were investigated.

62. Byler, R. E. Milling practice at Fresnillo. Min. Mag. (London), vol. 42, 1930, pp. 137–147.

The cyanidation of an oxidized silver ore and the differential flotation of a lead-silver-zinc sulphide ore are described.

63. Coldham, J. C. Ore concentration at the North Farrell mine, West Tasmania. Chem. Eng. and Min. Rev., vol. 22, 1930, pp. 320–322.

Complex lead-zinc-iron sulphide ore carrying silver treated first by jigs. The jig tailings, together with the original ore fines, are ground and treated by flotation.

64. Crabtree, E. H., Jr. Economic points in milling. Min. and Met., vol. 11, 1930, pp. 394–395.

Discusses assays of concentrates and tailings and cost of operation as primary factors in milling complex lead-zinc ores.

65. ———. Milling practice at the White Bird concentrator, Canam Metals Corporation, Picher, Okla. Inf. Circ. 6353, Bureau of Mines, 1930, 10 pp.

Ore consists of galena and sphalerite disseminated through a jasperoid breccia and filling the interstices between chert bowlders. The galena is easily liberated, and sphalerite is free at 48 mesh. Flow sheets, cost and metallurgical data, and description of plant operation are given.

66. Dalton, M. P., and Price, G. S. Milling practice at the Morning Mill, Idaho. Min. Cong. Jour., vol. 16, 1930, pp. 25–26.

Ore made up of intimate mixture of galena and sphalerite with gangue of siderite and quartzite. Straight flotation concentration is used. Operation of mill is described, and flow sheet and metallurgical data are given.

67. Dean, R. S. The milling and smelting of lead and zinc investigations of the U. S. Bureau of Mines. Min. Cong. Jour., vol. 16, 1930, pp. 799–808.

Review of investigations, including milling, hydrometallurgy, and pyrometallurgy of zinc and pyrometallurgy of lead.

68. Faerber, —. Flotation plant of Oued Oudina. (Die Schwimmaufbereitungsanlage von Oued Oudina.) Metallbörse, vol. 20, 1930, pp. 1377–1378.

Details of a lead-zinc flotation plant in Algeria are given.

69. Godard, J. S. Concentration of the silver-lead-zinc-barite ore of the Homestake mine, Adams Lake, near Kamloops, British Columbia. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 69–74.

Ore is a complex mixture of tetrahedrite, galena, sphalerite, and pyrite in a barite-silicate gangue. It is possible to produce lead concentrates, zinc concentrates, and barite concentrates.

70. Hey, H. The Electrolytic Zinc Co.'s concentrating mill at Rosebery, Tasmania. Chem. Eng. and Min. Rev., vol. 22, 1930, pp. 207–216.

Plant treats fine-grained and intimately associated sulphides from Rosebery and Hercules-Mountain Read mines; ores are similar, but Hercules-Mountain Read ore contains more lead and zinc and less iron. Details of crushing, grinding, and flotation sections are given.

71. Keough, O. E. Metallurgical control at the Tooele concentrator. Min. and Met., vol. 11, 1930, pp. 202–205.

A description of routine tests by which technical control is maintained is given. A complete description of plant is given in an article entitled "Selective Flotation of Lead-Zinc Ores at Tooele, Utah," by A. B. Young and W. J. McKenna, Eng. and Min. Jour., vol. 128, 1929, pp. 291–294.

72. Lewers, H. M. Flotation of lead-zinc at Tybo, Nev. Eng. and Min. Jour., vol. 130, 1930, pp. 218-220.

Flotation mill of the Treadwell-Yukon Mining Co. is described, and metallurgical data are included. Primary ore from lower levels contains galena, sphalerite, and pyrite. Minus 65-mesh grinding liberates these minerals from the gangue and from each other. Most of the silver present is associated with the galena. Some of the zinc is in the form of marmatite.

73. Lowe, S. P. Concentration and cyanidation at the Flin Flon pilot mill. Canadian Inst. Min. and Met., Bull. 221, 1930, pp. 1183–1205.

Ore is massive sulphide, carrying pyrite, sphalerite, galena, and chalcopyrite, with some gold and silver. A flotation concentrate is made, and the tailings are cyanided. Talc offered considerable trouble in the copper flotation in that it absorbed oils and reagents. The talc is removed in a set of cells ahead of the regular flotation circuit, pine oil being the only reagent used in this operation.

74. McKeown, M. R. Progress of metallurgy at Broken Hill, New South Wales. Chem. Eng. and Min. Rev., vol. 23, 1930, pp. 93–100.

A lead-zinc sulphide ore is treated. Equipment, operation, and reagents are described. Lead concentrates and zinc concentrates are produced by straight flotation in a circuit made alkaline with sodium carbonate.

75. Patzschke, —. Preparation of ore from German Bleischarley mines. (Die Aufbereitung der Deutsch-Bleischarleygrube.) Metall u. Erz, vol. 27, 1930, pp. 113-120.

Ore contains galena, sphalerite, and pyrite. The minerals are slightly oxidized, but good recoveries are effected.

76. Salau, H. J. Working up lead-zinc ores of the Ssadon mines in the dressing plant at Misur on the Alagir in the Caucasus. (Die Verarbeitung der Blei-Zink-Erze der Ssadon-Bergwerke in der Aufbereitungsanlage Misur bei Alagir im Kaukasus.) Metall u. Erz, vol. 27, 1930, pp. 281–285.

The ores contain lead, zinc, and iron sulphides easily treated by flotation. The plant and process are described.

77. Sansom, Frank W. Milling practice at the Netta mine of the Eagle-Picher Lead Co., at Picher, Okla. Inf. Circ. 6342, Bureau of Mines, 1930, 14 pp.

The ore contains galena and sphalerite. The gangue consists of flint or chert with some limestone. Pyrite is usually present; also some chalcopyrite is present at times. Ore is easily concentrated but requires fine grinding to liberate the sphalerite. Flow sheets, cost and metallurgical data, and description of plant operation are given.

78. Wainwright, W. E. Metallurgical practice at the Broken Hill South, New South Wales. Eng. and Min. Jour., vol. 129, 1930, pp. 349–350.

The ore contains galena and sphalerite and a small amount of silver. The gangue minerals are quartz, calcite, rhodonite, and garnet. Combined gravity and flotation treatment is used. The plant is described, and the flow sheet and metallurgical data are given.

79. Wilkins, E. G. Selective flotation on a lead-zinc graphite ore. Min. Mag. (London), vol. 42, 1930, pp. 349–352.

Results of tests to determine the best method for elimination of graphite from ore from Eagle lead mines (Trefriw). A flow sheet is given.

80. Wright, Ira L. Milling methods and costs at the Black Hawk concentrator, Hanover, N. Mex. Inf. Circ. 6359, Bureau of Mines, 1930, 15 pp.

The ore consists of galena and sphalerite with minor quantities of chalcopyrite, pyrite, and silver, in a limestone gangue containing some hedenbergite and garnet. The association of the silver is not known. A flow sheet and details of treatment and costs are given.

See also references 19, 87, 117, 121, 123, and 136.

For patent see reference 183.

GOLD-SILVER ORES

81. Anderson, A. K. Experimental tests for the recovery of gold from the ores of the Grace mine, Hawk Junction, Ontario. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 10–15.

Ore consists of free gold and small quantities of iron sulphides in hard quartzite. Cyanidation and concentration yield a higher recovery than amalgamation.

82. ———. Gold metallurgy. Canadian Min. Jour., vol. 51, 1930, pp. 966–968.

A review of developments in the metallurgy of gold during the past 50 years.

83. Clarke, Wm. G., and Moore, B. H. Treatment of Lake View and Star (Ltd.) low-grade sulphide ore. School of Mines of Western Australia, Bull. 5, 1930, pp. 19–30.

Various methods of treating a gold-bearing sulphide ore are discussed. A combination of gravity and flotation concentration followed by roasting and cyanidation of the concentrates was found to be the most economical method of treatment.

84. ———. Flotation of gold ore. Canadian Min. Jour., vol. 51, 1930, pp. 793–795.

Results of tests on low-grade ore of the Lake View and Star mine, Kalgoorlie, Western Australia, are given. Methods of extraction and concentration tried were: (1) Flotation in fresh water circuit; (2) extraction of gold by corduroy strakes; (3) combination of (1) and (2); and (4) amalgamation. Free gold must be removed before flotation. Amalgamation is as efficient as corduroy strakes. Fresh-water extraction is as good as salt-water extraction.

85. Denny, J. J. Gold milling in Canada. Canadian Inst. Min. and Met., Bull. 213, 1930, pp. 105–120.

Review of present and past practice is given. Flotation prior to cyanidation is discussed. Flow sheets of the following mills are included: (1) Hollinger Consolidated Gold Mines (Ltd.); (2) Dome Mining Co. (Ltd.); (3) McIntyre Porcupine Mines (Ltd.); (4) Coniaurum Mines (Ltd.), Schumacher, Ontario; (5) Lake Shore Mines (Ltd.), Kirkland Lake, Ontario; (6) Wright-Hargreaves (Ltd.), Kirkland Lake, Ontario; and (7) Teck-Hughes mill, Kirkland Lake, Ontario. See also Min. Jour. (London), vol. 169, 1930, p. 433, and South African Min. and Eng. Jour., April, 1930, p. 105.

86. Engineering and Mining Journal. Wiluna Gold: A new Western Australian enterprise. Eng. and Min. Jour., vol. 129, 1930, p. 513.

Wiluna mill treats a sulphide ore carrying gold. Ore assays 30 to 40 shillings per ton. Mining and treatment costs are about 19 shillings. A description of the flotation plant is given, and the method of roasting and cyaniding the concentrates is outlined.

87. Godard, J. S. Experimental tests on gold ore from Malartic mine, Fournière Township, Western Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 15–23.

Most of the gold is free; the remainder is associated with small quantities of iron, copper, zinc, and arsenic sulphides in a siliceous gangue. The most satisfactory method of treatment is by cyanidation. The ore can be treated by flotation. Since 85 per cent of the gold can be liberated by grinding (85 per cent through 200 mesh) a logical method would be to amalgamate ahead of flotation and to table the flotation tailing, the concentrate from this operation being returned to the flotation circuit.

88. ———. Experimental tests on gold ore from the Second Relief mine, Erie, British Columbia. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 58–62.

Ore assays 1.03 ounces of gold per ton, 0.05 per cent copper, 7.89 per cent of iron, 8.05 per cent sulphur, and 81.55 per cent of insoluble, with a trace of lead and arsenic. Amalgamation recovers 76 per cent of the gold when grinding 92 per cent through 200 mesh. Flotation and tabling recover 86 to 91 per cent of the gold, depending upon the percentage through 200 mesh. Amalgamation before concentration does not increase recoveries. The copper leads to excessive cyanide loss.

89. Leaver, E. S., and Woolf, J. A. Re-treatment of Mother lode carbonaceous slime tailings. Repts. of Investigations 2998, Bureau of Mines, 1930, 6 pp.

Combination of amalgamation and flotation followed by roasting and cyanidation of the flotation concentrates recovers more than 92 per cent of the gold in tailings containing 1.5 to 3 per cent carbon and sulphur.

90. ———. Re-treatment of Mother lode (California) carbonaceous slime tailings. Tech. Paper 481, Bureau of Mines, 1930, 20 pp.

91. Mathews, H. Shenandoah-Dives mill sheet. Mt. States Min. Age, vol. 1, 1930, pp. 12–30.

Mill for mine near Silverton, Colo., produces gold-copper and gold-copper-lead concentrates.

92. Parsons, C. S. Determining the association of gold values in ore samples from the Horne mine, Noranda, Quebec. Canadian Dept. Mines, Min. Branch, Rept. 711, 1930, pp. 6–8.

Gold associated with both pyrite and chalcopyrite. Two kinds of pyrite present, only one of which carries gold. Pyrrhotite does not carry gold. Only 50 per cent of the gold could be recovered in a clean chalcopyrite concentrate.

93. Traube, J. Occurrence and recovery of finely divided gold. Metall u. Erz, vol. 27, 1930, pp. 526–527.

Gold occurs in colloidal form in many minerals. Can be recovered by extremely fine grinding in a colloidal mill followed by flotation.

94. Welsch, O. D. Testing ores for recovery of gold content. Canadian Min. Jour., vol. 51, 1930, pp. 60–61.

Brief review of application of amalgamation, cyanidation, gravity concentration, and flotation concentration to simple and complex gold-bearing ores.

95. Winter, A. S., and Moore, B. H. Flotation of pyritic gold ores. Treatment of flotation concentrates. School of mines of Western Australia, Progress Repts. 1 and 2, 1930, pp. 4, 9.

Possibility of cyaniding flotation concentrates to recover the gold is discussed.

See also references 3, 8, 14, 17, 19, 24, 25, 28, 34, 36, 38, 39, 46, 53, 55, 59, 63, 72, 73, 78, 80, 91, 123, 138 142, and 146.

For patents see references 165, 168, 172, and 191.

MISCELLANEOUS ORES

96. Cayzer, W. J. The metallurgy of Transvaal platinum ores. South African Min. and Eng. Jour., vol. 40, 1930, pp. 3–4, 31–32.

Notes on gravity concentration of pyroxenite and norite ores. Flotation as a possible method of treating gravity tailings and slimes is discussed.

97. Clarke, Wm. G., and Moore, B. H. Progress report on the flotation of Wiluna antimonial ore. School of Mines of Western Australia, Bull. 5, 1930, pp. 5–12.

Selective flotation of the ore to produce antimony concentrates and gold concentrates is more feasible than the selective flotation of a bulk concentrate. See also Chem. Eng. and Min. Rev., vol. 22, 1930, pp. 294–295.

98. ———. Supplementary progress report on the flotation of Wiluna antimonial ore. School of Mines of Western Australia, Bull. 5, 1930, pp. 13–18.

Massive stibnite is removed by hand picking. Selective flotation of the bulk concentrate produced by the use of potassium xanthate does not appear feasible. Ten pointers on the selective flotation of the ore are given and discussed.

99. Davidovich, B. A., and Kireyev, A. A. Enrichment of Zavalye graphite. Miner. Suire, No. 5, January, 1930.

The ore from the Bug River Basin in Ukraine contains crystalline graphite. The method of grinding, flotation reagents used, and results of chemical, mineralogical, and petrographical analysis are given. (Russian.)

100. De Vaney, F. D., and Clemmer, J. B. Concentration tests on the manganiferous iron ores of the Cuyuna district, Minnesota. Rept. of Investigations 3045, Bureau of Mines, 1930, 9 pp.

Flotation can be used on gravity section slimes, or the ore may be crushed to flotation size and so treated.

101. Engineering and Mining Journal. Flotation of barite. Vol. 130, 1930, p. 168.

Barite-bearing tailings are treated by flotation. Concentrates contain 94 per cent barium sulphate, 1.5 per cent silica, 4.0 per cent calcium carbonate, and 0.6 per cent iron oxide. Flotation reagent covered by patent held by the Tonopah Mining Co. of Nevada.

102. ———. Manganese flotation a success. Vol. 129, 1930, p. 207.

Operations at the plant of the Anaconda Copper Mining Co. at Anaconda, Mont., have proved that rhodochrosite can be concentrated by flotation.

103. Fitzpatrick, A. S., and Elford, Harold S. Tin metallurgy in Great Britain—1929. Australasian Inst. Min. and Met., Proc. 78, 1930, pp. 81–161.

The geology of the ore deposits is described briefly. Treatment plants at nine properties are discussed. Part played by flotation in tin metallurgy is also discussed.

104. Gau, W. J., and Jamesone, J. Irvine. Tin mining in South Africa, with particular reference to the metallurgical practice at the Leeuwpoort Tin Mines (Ltd.), Transvaal. Third (Triennial) Empire Min. and Met. Cong., South Africa, 1930, 40 pp.

Mining and metallurgical methods used at the principal mines are reviewed. A flotation plant installed at the Leeuwpoort mine is described.

105. Gerth, G. Contribution to flotation of nonsulphidic minerals. (Beitrag zur Flotation nichtsulfidischer Mineralien.) Metall u. Erz, vol. 27, 1930, pp. 527–529. See also abstract in Min. Jour. (London), vol. 171, 1930, pp. 926.

Nonsulphide minerals are floated by means of sodium oleate. To prevent gangue minerals such as quartz and mica from floating sodium silicate and an acid or an acid salt are added to the circuit. Dropping of the quartz and mica is due to the formation of a silicic acid gel.

106. Thompson, William C. Methods of treating Madagascar graphite. Eng. and Min. Jour., vol. 130, 1930, pp. 4–6.

Unrefined graphite, mixed with petroleum under certain conditions, detaches itself from the impurities by floating.

See also references 9, 18, 22, 25, 29, 42, 43, 69, 123, 143, and 145.

For patents see references 164 and 166.

GENERAL

APPARATUS

107. Mayer, D. E. W. Pneumatic flotation machines in the flotation of minerals. Rass. Min. e Met. Italiana, vol. 70, 1930, pp. 31–32.

Describes pneumatic flotation apparatus.

108. ———. Pneumatic machines for ore flotation. (Las máquinas neumáticas para la flotación de minerales.) Revista Minera, vol. 81, 1930, pp. 171–173.

Reviews progress in flotation treatment of ores and describes pneumatic machines of types used in large installations in the United States. Special reference is made to Callow and MacIntosh and improved Callow-MacIntosh machines.

See also references 136, 137, 141, 142, 143, 145, and 147.

For patents see references 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, and 161.

CONTROL

109. Hazen, H. L. The pH value in flotation, and maximum profit. Eng. and Min. Jour., vol. 129, 1930, p. 438.

Dicusses importance of pH in flotation. Includes graphs for indicating method of ascertaining critical pH value for maximum recovery.

110. Magnus, Hans. The importance of hydrogen-ion concentration control in different branches of industry. Chem. Ztg., vol. 54, 1930, pp. 108–110.

Discusses application of pH control to various industries such as glue and gelatin, leather, textiles, cellulose, brewing, sugar, agriculture, dairying, plating, ore treatment, etc.

111. Martin, H. S. Microscopic studies of mill products as an aid to operation at the Utah Copper mills. Trans. Am. Inst. Min. and Met. Eng., 1930, pp. 458–480. Discussion, pp. 480–482. See also Am. Inst. Min. and Met. Eng., Tech. Pub. 255, 1929, 25 pp.

Describes extensive use of the microscope in solving mill problems at the Utah Copper mills.

112. McDermid, A. J. Liming mill water. Eng. and Min. Jour., vol. 130, 1930, p. 341.

Gives flow sheet and description of lime plant and method of treating mill water at the Miami Copper concentrator.

113. Prockat, F., and Kirchberg, H. Determination of hydrogen-ion concentration in ore slimes. (Die Bestimmung der Wasserstoffzahl in Erztrueben.) Metall u. Erz, vol. 27, 1930, pp. 120–121.

Various methods for determining pH in a flotation circuit are described, and the advantages and disadvantages of each method are discussed.

114. ———. Hydrogen-ion concentration of flotation slimes and its influence upon extraction and concentration of sulphidic copper ores. (Die Wasserstoffzahl der Schwimmtrübe in ihrem Einfluss auf Ausbringen und Anreicherung bei sulfidischen Kupfererzen.) Metall u. Erz, vol. 27, 1930, pp. 122–126.

Sulphidic copper ores in carbonate gangue are best floated in a neutral circuit. A complex copper-iron ore from Rammelsberg could not be floated, since the accompanying sulphides have a detrimental influence upon the flotation properties of the copper pyrites.

115. Slavin, M. Ore-dressing microscopy at United Verde. Min. Cong. Jour., vol. 16, 1930, pp. 386–387.

Discusses advantages of microscopic studies of mill products at United Verde.

See also references 40, 135, 136, 137, 138, 139, 140, 141, 142, 143, and 145.

REAGENTS

116. Alleynikov, N. A. Flotation properties of turpentine oils. Tzvetnuie Metallui, No. 6, 1930, pp. 826–840.

Report on the flotation characteristics of Russian turpentine oils, with special reference to their frothing properties. Gives results of experiments on turpentine flotation of copper and lead-zinc ores.

117. BACON, F. G. Possibilities of ammonia in complex-ore flotation. Eng. and Min. Jour., vol. 129, 1930, p. 404.

Ammonia is similar to cyanide in its behavior in the lead section of a flotation plant. Sphalerite is very easily depressed by a combination of ammonia and zinc sulphate and afterwards responds quite readily to activation by copper salts. Pyrite is easily depressed in the zinc circuit but can be floated later by adding sodium sulphide. If lime is used to depress pyrite in the zinc circuit, both the pyrite and sphalerite will be depressed; this is not true with ammonia. See also comment by Terry, J. T., Eng. and Min. Jour., vol. 129, 1930, p. 571.

118. HOLMAN, BERNARD W. Flotation reagents. Inst. Min. and Met. (London), Bull. 314, 1930, 53 pp.

Effects of solubility, chemical and electrochemical action, simple adsorption, differential ionic adsorption, hydrogen-ion concentration, surface area, surface structure, mass action, dilution, dissociation, or ionization, solution pressure, chemical equilibrium, abnormal surface energy, parachors, valence bonds, and structural orientation and constitution on the behavior of chemical flotation reagents are considered, and the use of certain reagents in practice is discussed.

119. ———. Flotation reagents. Inst. Min. and Met. (London), Bull. 315, 1930, pp. 2–4, 9–22.

120. KELLERMANN, K., and BENDER, E. Fundamentals of flotation with xanthates. I. Kolloid Ztschr., vol. 52, 1930, pp. 240–243.

Freshly prepared 0.1 per cent xanthate solution barely floats galena; after standing one-half hour the galena will float quite readily. Same effect produced by dissolving the xanthate in 0.01 normal sulphuric acid. Flotation is therefore effected by the hydrolysis products of xanthates. Butyl xanthates give the highest flotation yield. Polyhydroxyl xanthates are less active than the monohydric series.

121. LANDOLT, GEO. L., HILL, E. G., and LOWY, ALEXANDER. Flotation research on the relative activity of the various constituents of crude cresylic acid. Eng. and Min. Jour., vol. 129, 1930, pp. 351–352.

Results of tests on a lead-zinc ore in which the various constituents of crude cresylic acid were used as frothing and collecting agents are given. These results indicate that the value of crude cresylic acid as a frothing and collecting agent for galena or sphalerite depends largely upon the proportion of metacresol present in the acid.

122. MAYER, E. W. Chemicals used in flotation. I; II. Chem. Ztg., vol. 54, 1930, pp. 229–230, 250–251.

Flotation reagents, including collecting, frothing, conditioning, depressing, activating, modifying, and toxic and antitoxic reagents, are reviewed and discussed.

123. MILLER, T. H., and KIDD, R. L. Flotation reagents, 1928. Rept. of Investigations 3004, Bureau of Mines, 1930, 19 pp.

Report covering consumption data on flotation reagents for flotation plants in the United States during 1928, summarized by classes of ores treated. The quantities of the various classes of ores are stated in tons, and consumption of reagents is given in total pounds and pounds per ton of ore treated. Comparisons are made with practice in previous years, and trends are indicated.

124. TAGGART, A. F., TAYLOR, T. C., and INCE, C. R. Experiments with flotation reagents. Am. Inst. Min. and Met. Eng. (Milling Methods), 1930, pp. 285–368. See also Am. Inst. Min. and Met. Eng., Tech. Pub. 204, 1929, 75 pp.

Results of experimental work on collecting, frothing, and inorganic reagents.

See also references 2, 16, 56, 125, 129, 130, 132, 134, 136, 137, 141, 142, 143, 145, and 148.

For patents see references 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, and 192.

THEORY

125. BUCHANAN, G. H. Chemical tools of flotation. Min. and Met., vol. 11, 1930, pp. 565–570. See also Am. Cyan. Co., Tech. Paper 18, 1930.

The functions of frothing, collecting, activating, depressing, and conditioning reagents are explained in nontechnical language.

126. CHRISTMANN, L. J. Chemistry and the flotation process. Am. Cyan. Co., Tech. Paper 17, 1930, 12 pp.

An explanation of the mechanism of the flotation process. A résumé of the hypotheses and theories used in the laboratory of the American Cyanamid Co.

127. Grosvenor, Wm. M. A surface-tension effect. Science, vol. 72, 1930, pp. 244–245.

The behavior of air bubbles in Nujol is discussed. Supersaturation in gaseous solutions, disappearance of fine bubbles in viscous substances, flotation, and bumping can be understood better in the light of this behavior.

128. Huber-Panu, I. Status of flotation theory. (Stadiul actual al teoriei flotationei.) Ann. mines Roumanie, vol. 12, 1930, pp. 207–210; vol. 13, pp. 269–272; vol. 14, p. 307.

Theory and development of flotation processes are discussed, including review of Fahrenwald's study of surface tension.

129. Ince, C. R. A study of differential flotation. Am. Inst. Min. and Met. Eng. (Milling Methods), 1930, pp. 261–284. See also Am. Inst. Min. and Met. Eng., Tech. Pub. 195, 1929, 24 pp.

Theory advanced that sulphides coated with gangue slime will not float until an agent is added that will remove gangue-slime coating; results of tests on slime-coated and slime-free particles are given and discussed.

130. Mortsell, S. Later theories and investigation in flotation. (Nyare teorier och under sokningar rorande flotation.) Teknisk Tidskrift, vol. 60, 1930, pp. 1–6, 12–16, 23.

General discussion of the theory and progress of flotation.

131. Sulman, H. Livingstone. The concentration of ores by flotation. Third (Triennial) Empire Min. and Met. Cong., South Africa, 1930, 54 pp. South African Min. and Eng. Jour., vol. 41, pt. 1, 1930, pp. 201–202. Inst. Min. and Met. (London), Bull. 311, 1930, 38 pp. Inst. Min. and Met. (London). Bull. 315, 1930, pp. 5–6, 9–22.

General discussion of the principles, scope, physics, and mechanism of flotation.

132. Taggart, Arthur F., Taylor, T. C., and Knoll, A. F. Chemical reactions in flotation. Am. Inst. Min. and Met. Eng., Tech. Pub. 312, 1930, 33 pp. See also Am. Inst. Min. and Met. Eng. (Milling Methods), 1930, pp. 217–260.

Discussion of various reactions in flotation from a chemical standpoint. Brownian movement is explained from a new angle, and its part in flotation is discussed.

133. Talmud, D., and Lubman, N. M. Flotation and the electrical charge on precipitates. (Flotation und elektrische Ladung von Niederschlägen.) Kolloid Ztschr., vol. 50, 1930, pp. 163–164.

Frumkin's theory of the influence of the electric field upon adsorption of organic molecules demands a maximum flotability of a precipitate at its isoelectric point. This theory is verified by experiments.

134. ———. Flotation and hydrogen-ion concentration. (Flotation und pH.) Kolloid Ztschr., vol. 50, 1930, pp. 159–162.

Experimental work on flotability of hydrophile oxides, carbonates, and sulphates of light and heavy metals is given. The maximum flotability of oxides and carbonates is obtained in nearly neutral circuit. No regular relationship between flotability and hydrogen-ion concentration could be discovered for sulphates of metals.

135. Valentiner, Siegfried. Physical problems in the preparation of materials from the mining industry. Naturwissen, vol. 18, 1930, pp. 174–181.

Reviews flotation and its theory, settling processes, pneumatic separation, etc.

See also references 57, 61, 118, 120, 122, and 124.

MISCELLANEOUS

136. American Institute of Mining and Metallurgical Engineers. Milling methods, 1930. Trans., 1930.

Papers and discussions presented at meetings of the American Institute of Mining and Metallurgical Engineers during 1928, 1929, and the first half of 1930. Subjects covered are: Grinding and classification; gravity concentration (pneumatic); flotation; testing and calculation; and cyanidation.

137. Berthelot, C. Modern methods of concentrating minerals. (Les méthodes modernes de concentration des minerais.) Rev. Met., vol. 27, 1930, pp. 535–543.

A review of flotation methods, including definition and principles of flotation, is given. Paper also gives discussions of plan and layout of milling plants.

138. Börner, H. Application of a reclassification method to the flotation process for the improvement of ore-dressing results. Metall u. Erz, vol. 27, 1930, pp. 654–659.

Discussion of the use of uniform sieve analyses as a method of determining metal distribution in the products of the flotation of gold ores.

139. Diaz, L. Barcena Y. Ore concentration in 1929. (La concentratión de menas en 1929.) Revista Minera, vol. 80, 1929, pp. 559–561; vol. 81, 1930, pp. 1–3, 13–16, 38–41.

Milling data for various plants in United States and Canada are given, including a description of the Shattuck-Denn plant at Bisbee, Ariz. Papers include discussions of flotation machines, influence of flotation in zinc metallurgy, treatment of oxidized ores, general data on flotation, and plant flow sheets.

140. Gaudin, A. M. Selectivity index; a yardstick of the segregation accomplished by concentrating operations. Am. Inst. Min. and Met. Eng. (Milling Methods), 1930, pp. 483–487.

Describes result of attempts to arrive at a single quantitative measure of segregation between minerals or metals as the result of concentrating operations.

141. Hancock, R. T. The relative efficiency of ore-dressing processes. Min. Mag. (London), vol. 42, 1930, pp. 16–19.

Discusses new formula for calculating efficiencies of ore-dressing processes.

142. James, A. Progress in cyaniding and ore dressing. Eng. and Min. Jour., vol. 129, 1930, pp. 13–16.

Reviews filtration, roasting, fine grinding, slime leaching, and flotation.

143. Lehmann, C. Small concentrating plants. (Plantas chicas de concentratión.) Rev. Fin. Min., vol. 4, 1930, pp. 472–473, 489, 494–495, 514–515, 563–565, 635; vol. 5, 1930, pp. 697, 699, 701, 719, 721, 723, 739, 741, 761, 763–764, 792–793.

General discussion of the Fahrenwald flotation machine, including practical data on the design and operation of small mills. Includes notes on flotation machinery, flotation reagents, the general principles and application of the flotation process, and the flotation of gold and silver ores.

144. Madel, H. Progress in methods of ore dressing in 1929. (Fortschritte im Aufbereitungwesen im Jahre 1929.) Metall u. Erz, vol. 27, 1930, pp. 446–457.

Reviews fine grinding, screening, flotation, new flotation reagents, and the application of flotation to nonsulphide ores.

145. Michel, L. Origin of flotation. (Los origenes de la flotación.) Rev. Fin. Min., vol. 5, 1930, pp. 702–704.

Historical review of flotation.

146. O'Malley, G. B. The trend of ore dressing in the U. S. A. and Canada. Chem. Eng. and Min. Rev., vol. 22, 1930, pt. 1, pp. 243–247, pt. 2, pp. 287–293.

Discussion of the various methods of preparing ores and separating the valuable from the valueless minerals. Flotation of sulphides and nonsulphides and of coarse particles is discussed and reviewed.

147. Sundt, F. A. Custom flotation plants. (Plantas regionales de flotación.) Bol. Minero Soc. Nac. Min., vol. 42, 1930, pp. 116–117, 167–168.

Copper ore and gold ore buying schedules, with examples and calculations of rate of payment, are given.

148. Sweeney, E. L. The cost of building a flotation mill. Arizona Min. Jour., vol. 14, 1930, pp. 9–11.

Design, construction, and costs of a typical flotation plant built in the Southwest with operating results are given.

149. Zachert, Victor I. Effect of heat in cyaniding and flotation. Eng. and Min. Jour., vol. 129, 1930, p. 62.

Heat developed by the friction of fracturing ore particles is beneficial in flotation but tends to reduce the iron pyrite, and the iron combines with a cyanide radical to form ferrocyanide which is detrimental in either cyanidation or flotation.

See also reference 82.

PATENTS

APPARATUS

150. Bland, John. Apparatus and method of operation for separating minerals such as mica and feldspar by air flotation. U. S. Patent 1749371, Mar. 4, 1930.

151. Butchart, Wm. A. Apparatus for mineral flotation. U. S. Patent 1748107, Feb. 25, 1930.

Flotation machine, consisting of an elongated tank with porous sides for the introduction of air and with an agitating element extending lengthwise in the tank.

152. Fehely, Ralph C., and Stevenson, Raymond F. (Stevenson to Fehely). Apparatus for concentrating ores. U. S. Patent 1762265, June 10, 1930.
Structural features.
153. Houston, Henry B. Perforated and slitted rubber screen for use in flotation of ore pulps, etc. U. S. Patent 1759983, May 27, 1930.
154. Howard, Albert L. Apparatus for ore-pulp flotation. U. S. Patent 1752434, Apr. 1, 1930.
Structural features.
155. Lord, Robert (to Southwestern Engineering Co.). Mineral flotation apparatus. U. S. Patent 1743926, Jan. 14, 1930.
Structural features.
156. ———. Mineral flotation apparatus. U. S. Patent 1761136, June 3, 1930.
Structural features.
157. McTaggart, Arthur W. Apparatus for ore concentration by flotation. U. S. Patent 1744785, Jan. 28, 1930.
Structural features.
158. Molander, Alfred. Mineral separation by froth flotation. U. S. Patent 1777147, Sept. 30, 1930.
Apparatus and various details of procedure are described.
159. Ruth, Joseph P., Jr. Mineral flotation apparatus. U. S. Patent 1746682, Feb. 11, 1930.
Structural features.
160. ———. Apparatus for chemical treatment of ores preparatory to flotation. U. S. Patent 1755273, Apr. 22, 1930.
Structural features.
161. ———. Apparatus for flotation separation. U. S. Patent 1760916, June 3, 1930.
Structural features.
162. Thurn, Richard, and Schmierer, Eugene (to Baker Perkins Co.). Circulating drum and impeller device for use in dissolving xanthate. U. S. Patent 1742226, Jan. 7, 1930.
Structural features.

METHODS

163. Callow, John M. (to Union Carbide Sales Co.). Ore treatments such as acetylene treatment of copper ore before flotation. U. S. Patent 1774786, Sept. 2, 1930.
Crushed wet ore such as copper ore is mixed with calcium carbide in gas-tight chamber. Apparatus is described.
164. Ferris, Lockwood W. Froth flotation mineral concentration. U. S. Patent 1784280, Dec. 9, 1930.
Copper silicate minerals are heated alone to decompose the copper silicate. The heated material is then subjected to flotation.
165. Green, Wm. D. (to Combined Metals Reduction Co.). Separating resin from coal. U. S. Patent 1773997, Aug. 26, 1930.
A pulp is formed from resin-bearing coal, and a frothing agent such as ammonium hydroxide which has greater affinity for resin than for coal is added; the material is subjected to froth flotation to float selectively most of the resin.
166. Haehre, Einar (to Thomas Roberts and Co.). Treating silver ores. U. S. Patent 1747072, Feb. 11, 1930.
Native silver ores are sulphidized by means of an alkali sulphide and then floated.
167. Littleford, John W. (to Minerals Separation North American Corporation). Flotation concentration of phosphate-bearing material. U. S. Patent 1780022, Oct. 28, 1930.
A pulp relatively free from slimes is treated with an alkali such as sodium hydroxide, then a collector such as oleic acid and fuel oil is added and a concentrate removed.
168. Lowe, Sherwin P. (to Roscoe H. Channing, jr.). Flotation and concentration of ores. Canadian Patent 305960, Nov. 18, 1930.
Ores containing copper, zinc, and iron sulphides are treated by selective flotation to produce a copper concentrate and a zinc concentrate, with the tailings carrying most of the iron sulphide.
169. ———. Treatment of complex ores by flotation and cyaniding. Canadian Patent 305961, Nov. 18, 1930.

Complex ores selectively floated in the absence of cyanide to produce concentrates containing most of the base metals that are cyanicides; the flotation tailings are cyanided to recover the gold and silver. The cyanide solution is regenerated.

170. Lowe, Sherwin P., Fischer, Oscar A., Clampitt, Andis B., Koenig, Henry T., and Phelan, Robert E. (to Roscoe H. Channing, jr.). Canadian Patent 304291, Sept. 23, 1930.

A method for differential flotation of copper and zinc sulphides from a copper-zinc-iron sulphide ore.

171. Molander, A. Flotation. U. S. Patent 1777147, Sept. 30, 1930.

A flotation process consisting of three steps.

172. Phelan, Robert E., and Lowe, Sherwin P. (to Roscoe H. Channing, jr.). Froth-flotation concentration of ores. U. S. Patent 1771549, July 29, 1930.

Micaceous and talcky minerals are separated from sulphides by froth flotation in an alkaline pulp to which are added starch and cyanide.

173. Snyder, Edward H., and Green, Wm. D. (to Combined Metals Reduction Co.). Concentrating oxidized ores of lead, silver, and copper. U. S. Patent 1762364, June 10, 1930.

Preliminary treatment, before flotation, with sodium chloride and a sulphidizing agent.

REAGENTS

174. Bolton, Elmer K. (to E. I. duPont de Nemours & Co.). Ore-flotation concentration. U. S. Patent 1780000, Oct. 28, 1930.

A mercaptothiazole such as 1-mercapto-3-methyl-benzothiazole is used with frothing agents to facilitate concentration of the copper ores, etc.

175. Christmann, Ludwig J. (to American Cyanamid Co.). Flotation agent. Canadian Patent 302752, Aug. 5, 1930.

Sodium-diisopropyl-dithiophosphate used as flotation agent by formation of foam.

176. Derby, Ira H., and Cunningham, Orin D. (to Peter C. Reilly). Froth flotation of ores. U. S. Patent 1765302, June 17, 1930.

Reaction products of silicon disulphide and sodium ethylate $[(C_2H_5O)NaS.SiS]$ or silicon disulphide with sodium cresylate or phenate, sodium-mercaptol, sodium-cyclohexanol, mixed sodium salts of tar acids, hydrogenated phenols or mercaptol (or mixtures of these), or the corresponding compounds of potassium, calcium, barium, or strontium are used as collectors in froth flotation.

177. ———. Froth flotation of ores. U. S. Patent 1772386, Aug. 5, 1930.

Reaction product of a phosphorus sulphide with naphthalene combined with a phenalic compound used as a collecting reagent.

178. Douglass, William A. (to E. I. duPont de Nemours & Co.). Canadian Patent 305435, Nov. 4, 1930.

Flotation agents of the general formula $ROC(:S)SC(:O)OR'$, in which R and R′ are alkyl, are specified.

179. Hopkins, Marion B. (to Standard Oil Development Co.). Hydrocarbon products rich in unsaturated compounds. U. S. Patent 1767363, June 24, 1930.

The reaction product when treating hydrocarbon oil vapor at a moderate temperature in an oxidizing atmosphere. This product may be used for motor fuels, flotation oil, paint or varnish vehicle, etc.

180. James, Joseph H. (to Clarence P. Byrnes). Sulphonated derivatives of partial-oxidation products from petroleum hydrocarbons. U. S. Patent 1753516, Apr. 8, 1930.

Process described for sulphonating the products which are obtained by the catalytic partial oxidation of petroleum hydrocarbon materials in the presence of oxidation catalysts. These complex sulphonated mixtures or their alkali metal salts may be used as cleansing or emulsifying agents, in the manufacture of lubricants, as flotation reagents, in tanning, and for other purposes.

181. Johnson, Benjamin L. Concentrating ores by flotation. U. S. Patent 1763851, June 17, 1930.

The reaction product of concentrated sulphuric acid and diethyl dithiophosphoric acid is used as a flotation agent.

182. ———. Tetraethyl-tetrathio-dithiophosphate, etc. U. S. Patent 1763852, June 17, 1930.

A compound, $[(C_2H_5O)_2PS_2]2$, is produced by the reaction of concentrated sulphuric acid on diethyl-dithiophosphoric acid. This and other related compounds formed similarly may be used as flotation agents.

183. LANE, JOSEPH H. Ore flotation. U. S. Patent 1743463, Jan. 14, 1930.

Wood, such as pine sawdust, is reduced to a pulp to liberate flotation agents (frothers) which with collectors (such as xanthates) are used in a flotation circuit.

184. LOWE, SHERWIN P. (to Roscoe H. Channing, jr.). Flotation reagent. Canadian Patent 301971, July 8, 1930.

Zinc oxide used to precipitate soluble salts such as copper sulphate or iron sulphate present in flotation circuit treating complex ores containing copper or lead and zinc.

185. LUCKENBACH, ROYER. Selective agent for concentration of ore by flotation. U. S. Patent 1780024, Oct. 28, 1930.

Seven parts of heavy asphalt-base petroleum oil are mixed with one to two parts of horse-grease oil.

186. LUTZ, GEORGE (to Grasselli Chemical Co.). Mineral flotation separation. U. S. Patent 1765308, June 17, 1930.

An alkyl-naphthalene-sulphonic acid compound such as sodium-propyl-naphthalene-sulphonate is used to assist flotation separation.

187. MILLER, STUART P. (to Barrett Co.). Ore flotation. U. S. Patent 1785742, Dec. 23, 1930.

A reagent composed of alpha-naphthylamine, obtained by dissolving crude alpha-naphthylamine in an organic solvent, then partly crystallizing the alpha-naphthylamine content of the solution and separating the crystals.

188. MOSES, FREDERICK G., HESS, RAYMOND W., and PERKINS, ROBERT L. (to Barrett Co.). Concentrating minerals by froth flotation. U. S. Patent 1774183, Aug. 26, 1930.

Flotation of copper sulphide ore; a sulphide is used such as dibenzyl-disulphide or ethyl-disulphide of the probable formula $R-S_x-R'$, in which R and R' stand for the same or different alkyl or aralkyl radicals and x has a value of 1 or more.

189. QUIGLEY, CHARLES G. Frothing agent for ore concentration. U. S. Patent 1771550, July 29, 1930.

A material comprising a mixed sulphate of an organic radical and an alkali-forming metal, that is, calcium or sodium amyl sulphate or salts of organic sulphuric acids derived from acid sludge of petroleum refining.

190. ———. Froth flotation concentration of ores. U. S. Patent 1773787, Aug. 26, 1930.

In floating copper sulphides there is used as a frothing agent calcium amyl sulphate or other suitable compound of sulphuric acid in which 1 hydrogen atom is replaced by an organic radical.

191. SIEDLER, PHILIPP, and MOELLER, AUGUST (to I. G. Farbenind.). U. S. Patent 1780634, Nov. 4, 1930.

Froth flotation agent consisting of a supersaturated solution of thiocarbanilide in "technically pure" toluidine and 0.3 to 20 per cent of resin such as colophony.

192. WIGTON, GEORGE W. Concentration of ores. Canadian Patent 299072, Apr. 8, 1930.

The reaction product of an alcohol solution of an amino compound and phosphorus pentasulphide is used as a collector on oxidized ores.

193. ———. Froth flotation ore separation. U. S. Patent 1783206, Dec. 2, 1930.

Flotation of oxidized ore by means of the reaction product of an alcoholic solution of alpha-napthylamine or other amino compound and phosphorus pentasulphide. U. S. Patent 1783207 covers the reaction product of an oxygen-free aromatic amino compound such as alpha-napthylamine and ortho-toluidine and phosphorus pentasulphide.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO[1][2]

(MINE REPORT)

By Chas. W. Henderson

CONTENTS

Page
Summary 793
Mining industry 796
  Ore classification 798
Metallurgic industry 799
Review by counties and districts 801
  Catron County 801
  Colfax County 802
  Dona Ana County 802
  Grant County 802
  Guadalupe County 806
  Hidalgo County 806
  Lincoln County 807

Review by counties and districts—Con.

Page
  Luna County 807
  Otero County 808
  Sandoval County 808
  San Miguel County 808
  Santa Fe County 809
  Sierra County 809
  Socorro County 810
  Taos County 811
  Torrance County 811
  Valencia County 811

SUMMARY

The total calculated gross value of the recoverable gold, silver, copper, lead, and zinc from lode and placer mines in New Mexico in 1930 amounted to $13,748,217, compared with $24,473,675 in 1929—a decrease of 43.82 per cent. There were 93 producing mines in 1930, comprising 88 lode mines and 5 placers, a decrease from 1929 of 25 lode mines and 3 placers.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed April, 1932.

[2] Published data on the metal resources of New Mexico are scanty. The mine report series of Mineral Resources, of which this chapter forms a part, have been published annually since 1904. Annual reports of the Director of the Mint begin with the year 1880. Professional Paper 68 of the U. S. Geological Survey, published in 1910, is a most valuable reference book covering the whole State. The Report of the Appraisal of Mining Properties of New Mexico, by J. R. Finlay, for the State Tax Commission, Santa Fe, 1921-22, contains valuable notes. Additional references are given in the section of this chapter, "Review by counties and districts," pp. 801 to 811.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1921–1930, in terms of recovered metals

Year	Mines producing			Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Total		Fine ounces	Value	Fine ounces	Value
1921	40	9	49	611, 576	9, 521. 26	$196, 822	571, 899	$571, 899
1922	74	17	91	1, 576, 920	19, 964. 02	412, 693	752, 240	752, 240
1923	104	16	120	3, 111, 050	26, 689. 12	551, 713	747, 127	612, 644
1924	86	10	96	3, 040, 652	24, 803. 56	512, 735	795, 070	532, 697
1925	92	12	104	3, 358, 566	26, 561. 40	549, 073	735, 124	510, 176
1926	116	12	128	3, 825, 894	19, 630. 72	405, 803	450, 934	281, 383
1927	102	10	112	3, 442, 184	29, 241. 87	604, 483	890, 083	504, 677
1928	93	6	99	4, 073, 974	32, 912. 41	680, 360	827, 793	484, 259
1929	113	8	121	4, 506, 807	35, 176. 46	727, 162	1, 121, 546	597, 784
1930	88	5	93	2, 971, 441	32, 370. 42	669, 156	1, 107, 335	426, 324

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	14, 267, 338	$1, 840, 487	678, 601	$30, 537	228, 000	$11, 400	$2, 651, 145
1922	31, 937, 207	4, 311, 523	3, 012, 223	165, 672	4, 496, 806	256, 318	5, 898, 446
1923	61, 356, 802	9, 019, 450	3, 832, 427	268, 270	16, 496, 000	1, 121, 728	11, 573, 805
1924	74, 691, 436	9, 784, 578	3, 634, 511	290, 761	20, 759, 200	1, 349, 348	12, 470, 119
1925	76, 427, 825	10, 852, 751	6, 420, 060	558, 545	18, 492, 300	1, 405, 415	13, 875, 960
1926	81, 642, 379	11, 429, 933	6, 960, 366	556, 829	24, 104, 800	1, 807, 860	14, 481, 808
1927	74, 251, 863	9, 726, 994	16, 052, 855	1, 011, 330	59, 603, 000	3, 814, 592	15, 662, 076
1928	89, 854, 646	12, 939, 069	15, 610, 501	905, 409	62, 406, 000	3, 806, 766	18, 815, 863
1929	97, 717, 262	17, 198, 238	22, 260, 811	1, 402, 431	68, 910, 000	4, 548, 060	24, 473, 675
1930	65, 150, 000	8, 469, 500	20, 756, 900	1, 037, 845	65, 529, 000	3, 145, 392	13, 748, 217

Gold and silver produced at placer mines in New Mexico, 1921–1930

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1921	400. 59	$8, 281	61	$61	$8, 342
1922	190. 21	3, 932	39	39	3, 971
1923	204. 05	4, 218	30	24	4, 242
1924	176. 04	3, 639	27	18	3, 657
1925	97. 62	2, 018	13	9	2, 027
1926	129. 98	2, 687	45	28	2, 715
1927	280. 97	5, 808	32	18	5, 826
1928	65. 16	1, 347	17	10	1, 357
1929	79. 82	1, 650	4	2	1, 652
1930	63. 66	1, 316	18	7	1, 323

GOLD

The mine production of recoverable gold in New Mexico in 1930 was valued at $669,156, compared with $727,162 in 1929. Hidalgo County produced 43.33 per cent of the total in 1930, San Miguel 40.52 per cent, Grant 11.85 per cent, and Catron 2.88 per cent. Copper ore yielded 52.95 per cent of the total gold, lead-zinc ore 40.87 per cent, and dry and siliceous ore 5.80 per cent. Placer mines yielded less than 1 per cent.

SILVER

The mine production of recoverable silver in New Mexico in 1930 amounted to 1,107,335 fine ounces, valued at $426,324, compared with 1,121,546 fine ounces, valued at $597,784, in 1929. Grant County produced 37.33 per cent of the total, chiefly from the Central district; San Miguel County 36.74 per cent, all from the lead-zinc ore of the Pecos mine in the Willow Creek district; Hidalgo County 17.53 per cent, chiefly from the copper ore of the Lordsburg district; Catron County 5.56 per cent, from the Mogollon district; Sierra County 1.67 per cent, chiefly from the Chloride district; and Socorro County 0.71 per cent, nearly all from the Magdalena district.

Lead-zinc ore from Grant and San Miguel Counties yielded 67.25 per cent of the total silver; copper ore, chiefly from Grant and Hidalgo Counties, 20.63 per cent; dry and siliceous ore, chiefly from Catron, Hidalgo, and Sierra Counties, nearly 10.10 per cent; and lead ore, chiefly from Grant, Socorro, and Hidalgo Counties, 2.02 per cent.

COPPER

The mine production of recoverable copper in New Mexico in 1930 amounted to 65,150,000 pounds, valued at $8,469,500, compared with 97,717,262 pounds, valued at $17,198,238, in 1929. Grant and Hidalgo Counties produced 95.88 per cent of the total in 1930, chiefly from the operations of the Santa Rita mines in the Central district, Grant County, and from the Eighty-Five mine in the Lordsburg district, Hidalgo County. San Miguel County, third in order of output, yielded 2.21 per cent from the lead-zinc ore of the Pecos mine. Copper ore yielded 93.70 per cent and lead-zinc ore 5.67 per cent of the total copper.

LEAD

The mine production of recoverable lead in New Mexico in 1930 amounted to 20,756,900 pounds, valued at $1,037,845, compared with 22,260,811 pounds, valued at $1,402,431, in 1929. The chief lead-producing districts were the Willow Creek district, San Miguel County; the Central district, Grant County; the Magdalena district, Socorro County; and the San Simon district, Hidalgo County. Lead-zinc ore yielded 87.41 per cent and lead ore 7.57 per cent of the total lead.

ZINC

The mine production of recoverable zinc in New Mexico in 1930 amounted to 65,529,000 pounds, valued at $3,145,392, compared with 68,910,000 pounds, valued at $4,548,060, in 1929. The chief zinc-producing districts in 1930 were the Willow Creek in San Miguel County and the Central in Grant County. Other producing zinc districts were the Magdalena in Socorro County, and the Swartz in Grant County.

Zinc concentrates produced in 1930 amounted to 70,712 tons, containing, as shipped, 1,347.94 ounces of gold, 137,913 ounces of silver, 1,045,543 pounds of copper, 1,850,901 pounds of lead, and 77,869,576 pounds of zinc. The average zinc content was therefore 55.06 per cent.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1930, by counties, in terms of recovered metals

County	Mines producing			Ore (short tons)	Gold (lode and placer)	Silver (lode and placer)	
	Lode	Placer	Total			Fine ounces	Value
Catron	1		1	6, 554	$19, 270	61, 621	$23, 724
Colfax	1		1	150	248		
Dona Ana	2		2	897	3, 113	1, 587	611
Grant	27	4	31	2, 676, 456	79, 300	413, 379	159, 151
Guadalupe	1		1	10, 123		1, 013	390
Hidalgo	17		17	105, 177	289, 943	194, 104	74, 730
Lincoln	3		3	27	133	179	69
Luna	3		3	374	306	904	348
Otero	8		8	1, 665	405	426	164
San Miguel	1		1	151, 943	271, 127	406, 865	156, 643
Santa Fe	3	1	4	465	1, 560	870	335
Sierra	10		10	11, 486	3, 638	18, 465	7, 109
Socorro	8		8	5, 947	113	7, 808	3, 006
Torrance	2		2	120		57	22
Valencia	1		1	57		57	22
	88	5	93	2, 971, 441	669, 156	1, 107, 335	426, 324
Total, 1929	113	8	121	4, 506, 807	727, 162	1, 121, 546	597, 784

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron	2, 400	$312	1, 000	$50			$43, 356
Colfax							248
Dona Ana	17, 000	2, 210	11, 000	550			6, 484
Grant	57, 604, 600	7, 488, 598	8, 047, 500	402, 375	30, 783, 000	$1, 477, 584	9, 607, 008
Guadalupe	951, 000	123, 630					124, 020
Hidalgo	4, 863, 500	632, 255	504, 200	25, 210			1, 022, 138
Lincoln	700	91	12, 900	645			938
Luna	500	65	51, 000	2, 550			3, 269
Otero	32, 000	4, 160	285, 600	14, 280			19, 009
San Miguel	1, 438, 000	186, 940	10, 861, 000	543, 050	33, 276, 000	1, 597, 248	2, 755, 008
Santa Fe	79, 100	10, 283					12, 178
Sierra	72, 700	9, 451	400	20			20, 218
Socorro	72, 900	9, 477	982, 300	49, 115	1, 470, 000	70, 560	132, 271
Torrance	9, 000	1, 170					1, 192
Valencia	6, 600	858					880
	65, 150, 000	8, 469, 500	20, 756, 900	1, 037, 845	65, 529, 000	3, 145, 392	13, 748, 217
Total, 1929	97, 717, 262	17, 198, 238	22, 260, 811	1, 402, 431	68, 910, 000	4, 548, 060	24, 473, 675

MINING INDUSTRY

The output of zinc surpassed that of copper in quantity, but in value copper continued in 1930 to be the most important metal produced in New Mexico. The large low-grade porphyry copper deposit of Chino Mines of the Nevada Consolidated Copper Co. at Santa Rita was mined at the rate of approximately 6,900 tons daily, as compared with 10,886 tons daily in 1929. The deposit is mined by open-pit methods, using steam and electric shovels; and the ore is concentrated at the company's flotation mill at Hurley, which has a full capacity of 15,000 tons a day in its seven units. The Lordsburg district, the second largest copper producer in the State, shipped approximately 100,000 tons of siliceous copper-gold-silver ores in 1930, as compared with about 83,000 tons in 1929. The 1930 output was shipped chiefly to Douglas, Ariz., but some was also sent to El Paso, Tex. The largest producing mine in the Lordsburg district is the Eighty-Five. Other producers in the district in 1930 were the Anita, Alamo, Bonney, Last Chance, Miser's Chest, Robert E. Lee, and Ruth. The Hanover Bessemer Iron & Copper Co. at Fierro shipped several hundred tons of copper ore to the El Paso copper smelter and about 173,000 gross tons of iron ore, chiefly to the steel plant at Pueblo, Colo. Copper carbonate siliceous ores were shipped until August, 1930, from Pastura, Guadalupe County. Copper concentrates made at the Pecos zinc-lead-copper-silver-gold mine were shipped with the lead concentrates to the El Paso smelter.

The Pecos mine of the American Metal Co. on Willow Creek, San Miguel County, in its fourth year of production, continued to produce about 300 tons a day, or at one-half capacity for the first half of 1930, but stepped up the output to 450 tons during the second half of the year. The ore minerals in this complex sulphide ore body are sphalerite, galena, chalcopyrite, and pyrite, and the gangue is a sheared micaceous diorite. The ore bodies are mined both by the cut-and-fill system and by square-set stopes. In 1930 the main shaft was sunk to the tenth level. The mine and mill are connected by a 12-mile aerial tramway. The capacity of the mill, a selective flotation plant, is 600 tons a day.

This mine is the largest single producer of gold, silver, lead, and zinc in New Mexico. Other large producers of zinc concentrates were the Empire Zinc Co. 300-ton flotation mill and the Black Hawk selective 175-ton flotation mill, both at Hanover, and the Peru 2-unit (full capacity, 300 tons) selective flotation mill at Wemple near Deming. A. L. Owen produced several cars of zinc concentrates in the Grand Central or Royal John selective flotation mill at Swartz, and lessees at Magdalena shipped crude zinc-lead sulphide ore to Coffeyville, Kans.

The Pecos, Black Hawk, Peru, and Royal John mills also produced lead concentrates. The Pecos and Combination lead concentrates contained much lead and silver (as well as copper), and the gold content of the Pecos lead concentrates made that mine the largest gold mine in the State. Other producing lead districts were the Organ Mountains district, Dona Ana County; the Hanover district, Grant County; the High Rolls district, Otero County; the Magdalena district, Socorro County; and the San Simon district, Hidalgo County.

The second largest gold-producing district was the Lordsburg; and the copper concentrates from Chino Mines contained considerable gold and silver in the aggregate, although the content per ton was low. Several shipments of gold-silver concentrate were made from the Mogollon district, Catron County; a small lot of gold concentrates was shipped from the Aztec mine, Colfax County; and placer gold bullion was shipped from the Pinos Altos district, Grant County. A new flotation mill—the Silver Monument in Sierra County—produced high-grade silver-copper concentrates.

Further details will be found under the section "Review by Counties and Districts," page 801.

ORE CLASSIFICATION

Ore sold or treated in New Mexico in 1930, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	325	111.46	276	1,600		
Dry gold and silver ore	14,825	1,754.83	95,566	246,100	79,700	
Dry silver ore	13,783	11.59	15,959	51,000	253,100	
	28,933	1,877.88	111,801	298,700	332,800	
Copper ore	2,636,107	17,138.87	228,494	61,048,300	15,900	
Lead ore	5,726	61.04	22,346	108,000	1,571,200	
Lead-zinc ore	211,562	13,228.97	744,676	3,695,000	18,144,000	45,154,000
Zinc ore	89,113				693,000	20,375,000
	2,942,508	30,428.88	995,516	64,851,300	20,424,100	65,529,000
Total, lode mines	2,971,441	32,306.76	1,107,317	65,150,000	20,756,900	65,529,000
Total, placers		63.66	18			
	2,971,441	32,370.42	1,107,335	65,150,000	20,756,900	65,529,000
Total, 1929	4,506,807	35,176.46	1,121,546	97,717,262	22,260,811	68,910,000

Ore sold or treated in New Mexico in 1930, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Colfax	150	12.00				
Grant	11	4.90	53	400		
Hidalgo	26	12.00	17			
Lincoln	1	6.14	2			
Santa Fe	100	30.32	5			
Sierra	37	46.10	199	1,200		
	325	111.46	276	1,600		
Total, 1929	200	60.44	279	1,580	2,024	

DRY GOLD AND SILVER ORE

Catron	6,554	932.19	61,621	2,400	1,000	
Dona Ana	805	142.39	1,218	17,000	1,000	
Grant	56	22.55	1,249			
Hidalgo	7,409	655.90	31,429	226,700	77,700	
Sierra	1	1.80	49			
	14,825	1,754.83	95,566	246,100	79,700	
Total, 1929	4,050	914.53	50,942	140,338	58,604	

DRY SILVER ORE

Hidalgo	2,500		3,356	500	253,000	
Sierra	11,283	11.59	12,603	50,500	100	
	13,783	11.59	15,959	51,000	253,100	
Total, 1929	608	2.52	2,806	11,386	12,354	

Ore sold or treated in New Mexico in 1930, by counties, with content in terms of recovered metals—Continued

COPPER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Grant	2,529,286	3,620.10	61,215	55,263,400	13,800	
Guadalupe	10,123		1,013	951,000		
Hidalgo	94,810	13,342.58	157,566	4,634,100	1,200	
Otero	585	19.59	190	21,300	100	
Santa Fe	365	39.00	865	79,100		
Sierra	164	116.40	5,515	21,000		
Socorro	597	1.20	2,016	62,800	800	
Torrance	120		57	9,000		
Valencia	57		57	6,600		
	2,636,107	17,138.87	228,494	61,048,300	15,900	
Total, 1929	4,114,187	17,300.12	270,385	92,995,631	67,864	

LEAD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Dona Ana	92	8.20	369		10,000	
Grant	2,066	17.87	13,033	83,800	634,700	
Hidalgo	432	15.51	1,736	2,200	172,300	
Lincoln	26	.29	177	700	12,900	
Luna	374	14.80	904	500	51,000	
Otero	1,080		236	10,700	285,500	
Sierra	1	.10	99		300	
Socorro	1,655	4.27	5,792	10,100	404,500	
	5,726	61.04	22,346	108,000	1,571,200	
Total, 1929	16,265	138.68	43,995	68,057	2,849,620	

LEAD-ZINC ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Grant	59,347	113.20	337,811	2,257,000	7,276,000	11,783,000
San Miguel	151,943	13,115.77	406,865	1,438,000	10,861,000	33,276,000
Socorro	272				7,000	95.000
	211,562	13,228.97	744,676	3,695,000	18,144,000	45,154,000
Total, 1929	306,042	16,679.25	733,146	4,347,962	18,213,800	58,245,000

ZINC ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Grant	85,690				123,000	19,000,000
Socorro	3,423				570,000	1,375,000
	89,113				693,000	20,375,000
Total, 1929	63,088				70,000	10,665,000

METALLURGIC INDUSTRY

The markets for New Mexico ore and concentrates are all outside the borders of the State. Lead ores and concentrates are sold to the American Smelting & Refining Co. lead plant at El Paso, Tex., and to the Copper Queen lead plant at Douglas, Ariz. Copper ore and concentrates are sold to the American Smelting & Refining Co. copper plant at El Paso, to the Copper Queen copper smelter at Douglas, and to the Calumet and Arizona copper plant at Douglas. In the past some copper ore has gone to the American Smelting & Refining Co. copper plant at Hayden, Ariz. Zinc ore and concentrates are shipped to the United States Zinc Co. natural-gas retort plant at Amarillo, Tex.; to the Mineral Point Zinc Co. producer-gas retort plant at Depue, Ill.; to the Illinois Zinc Co. retort plant at Peru, Ill.; to the Ozark Smelting & Mining Co. zinc-pigment plant at Coffeyville, Kans.; to the American Metal Co. natural-gas retort plant at Blackwell, Okla., and producer-gas retort plant at Langeloth, Pa.; and to the Empire Zinc Co. zinc oxide plant at Canon City, Colo. Iron ore and iron-manganese ore go to Pueblo, Colo.

Mine production of metals in New Mexico in 1930, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amalgamation	100	35.16	242	----------	----------	----------
Concentrates smelted	[1] 189,367	17,673.16	871,402	58,122,400	18,514,000	64,059,000
Ore smelted	140,376	14,598.44	235,673	7,027,600	2,242,900	1,470,000
Placer	----------	63.66	18	----------	----------	----------
	----------	32,370.42	1,107,335	65,150,000	20,756,900	65,529,000
Total, 1929	----------	35,176.46	1,121,546	97,717,262	22,260,811	68,910,000

[1] From 2,830,965 tons of ore concentrated.

Gross metal content of New Mexico concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	5	12.00	----------	----------	----------	----------
Dry gold and silver	92	845.79	56,879	1,997	1,242	----------
Copper	91,731	3,586.40	66,491	56,693,703	----------	----------
Copper-lead	26,222	12,344.31	628,179	4,161,977	19,636,447	5,739,595
Lead	408	2.90	6,137	998	406,287	13,000
Lead-zinc	197	----------	89	----------	51,891	174,613
Zinc	70,712	1,347.94	137,913	1,045,543	1,850,901	77,869,576
	189,367	18,139.34	895,688	61,904,218	21,946,768	83,796,784
Total, 1929	258,078	23,111.36	866,507	94,093,155	22,544,000	88,733,250

Mine production of metals from concentrating mills in New Mexico in 1930, by counties, in terms of recovered metals

County	Ore treated	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Catron	6,515	92	845.79	56,879	1,400	1,000	----------
Colfax	150	5	12.00	----------	----------	----------	----------
Grant	2,658,597	136,122	3,688.20	392,029	56,632,000	7,399,000	30,783,000
Hidalgo	2,500	251	----------	3,356	500	253,000	----------
San Miguel	151,943	52,774	13,115.77	406,865	1,438,000	10,861,000	33,276,000
Sierra	11,260	123	11.40	12,273	50,500	----------	----------
	2,830,965	189,367	17,673.16	871,402	58,122,400	18,514,000	64,059,000
Total, 1929	4,350,301	258,078	22,901.16	832,618	88,997,543	18,965,994	68,645,000

Gross metal content of New Mexico crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	75	69.14	271	1,801		
Dry gold and silver	8,310	904.20	38,450	261,632	142,495	
Dry silver	23	.19	330	23	280	
Copper	122,547	13,563.87	174,276	7,550,547	32,696	143
Lead	5,726	61.04	22,346	157,664	1,745,973	893
Lead-zinc	272		847		14,157	119,000
Zinc	3,423				814,763	1,718,534
	140,376	14,598.44	236,520	7,971,667	2,750,364	1,838,570
Total, 1929	156,506	12,195.84	295,477	9,684,065	3,817,102	462,988

Mine production of metals from New Mexico crude ore shipped to smelters in 1930, by counties, in terms of recovered metals

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Catron	39	86.40	4,742	1,000		
Dona Ana	897	150.59	1,587	17,000	11,000	
Grant	17,859	85.58	21,095	972,600	648,500	
Guadalupe	10,123		1,013	951,000		
Hidalgo	102,677	14,025.99	190,748	4,863,000	251,200	
Lincoln	27	6.43	179	700	12,900	
Luna	374	14.80	904	500	51,000	
Otero	1,665	19.59	426	32,000	285,600	
Santa Fe	365	39.00	865	79,100		
Sierra	226	164.59	6,192	22,200	400	
Socorro	5,947	5.47	7,808	72,900	982,300	1,470,000
Torrance	120		57	9,600		
Valencia	57		57	6,600		
	140,376	14,598.44	235,673	7,027,600	2,242,900	1,470,000
Total, 1929	156,506	12,195.48	288,924	8,719,719	3,294,817	265,000

REVIEW BY COUNTIES AND DISTRICTS

CATRON COUNTY

Mogollon district.[3]—A brief history of mining in the Mogollon district will be found in the 1929 report of this series. Experimentation in November and December, 1929, in the use of flotation resulted in the operation of the remodeled Little Fanney mill from January 1 to May 15, 1930, at the rate of 65 tons daily on ore from the Little Fanney and Johnson. Flotation gold and silver concentrates were shipped to the El Paso smelter. Work ceased in May, but in December workmen returned to repair the mine and mill preparatory to resumption of milling in 1931. The other properties in the district were idle in 1930.

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[3] Scott, D. B., Ore Deposits of the Mogollon District: Trans. Am. Inst. Min. and Met. Eng., vol. 63, 1920, pp. 289–310; Kidder, S. J., Mining Methods in Mogollon District, N. Mex.: Trans. Am. Inst. Min. and Met. Eng., vol. 72, 1925, pp. 529–549; Ferguson, H. G., Geology and Ore Deposits of the Mogollon Mining District, N. Mex.: U. S. Geol. Survey Bull. 787, 1927, 100 pp.

Mine production of gold, silver, copper, and lead in Mogollon or Cooney district, Catron County, N. Mex., 1921–1930, in terms of recovered metals

Year	Ore	Gold	Silver	Copper	Lead	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	
1921	48,870	$126,791	310,774			$437,565
1922	48,106	142,133	322,460			464,593
1923	47,644	179,351	398,714			506,296
1924	72,736	230,960	618,094			645,083
1925	52,118	163,322	449,699			475,413
1926	976	12,444	28,404	24,400		33,584
1927	89	4,678	3,591			6,714
1928	81	4,189	16,800	17,000		16,465
1929	438	15,287	40,437	15,187		39,513
1930	6,554	19,270	61,621	2,400	1,000	43,356

COLFAX COUNTY

Mount Baldy district (*Baldy, Elizabethtown, Therma*).—A brief history of mining in the Mount Baldy district will be found in the 1929 report of this series. In 1930 lessees on the mill-tailing dump of the Aztec[4] mill handled daily 10 tons of old tailing for part of a month in two J. I. B. flotation machines. The few tons of gold concentrate produced were shipped to the Golden Cycle mill at Colorado Springs, Colo. Prospecting for the south rim of the South Ponil Creek placer resulted in the incidental recovery of about 2 ounces of placer gold. The other placers in the district were idle.

DONA ANA COUNTY

Organ district.—In 1930 production from Dona Ana County was confined to shipments of dump material from various properties near Organ to the El Paso smelter. The bulk of the ore was gold-silver ore carrying a little lead and copper; 2 cars were lead-silver-gold ore.

GRANT COUNTY[5]

Burro Mountain district (*Tyrone*).[6]—In 1930 the Azure Leasing Co. shipped 2,707 tons of siliceous ore, carrying 2.71 per cent of copper, from the Emerald mine to Douglas, Ariz., and El Paso, Tex. Lessees on the St. Louis, Old Virginia, and Copper Mountain claims of the Burro Mountain branch (Tyrone) of the Phelps Dodge Corporation shipped 2,884 tons of siliceous mixed oxide and sulphide copper ore to the Copper Queen copper smelter, Douglas, Ariz. There were no operations by the corporation. One car of lead-silver-gold ore from the Woodward property was shipped to the El Paso smelter.

Central district (*Bayard, Fierro, Georgetown, Hanover, Santa Rita*).—The Central district continued to hold its place in 1930 as the principal producing district in New Mexico; it also is known for the variety of its ores.

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[4] Chase, C. A., and Muir, Douglas, The Aztec Mine, Baldy, N. Mex.: Trans. Am. Inst. Min. and Met. Eng., vol. 68, 1923, pp. 270–281. *See also* Finlay, J. R., Report of Appraisal of Mining Properties of New Mexico, Santa Fe, State Tax Commission, 1921–22; Lee, W. T., The Aztec Gold Mine, Baldy, N. Mex.; Contributions to Economic Geology, 1915, Part I: U. S. Geol. Survey Bull. 620, 1916, pp. 325–330.

[5] For a description of the geology of Bear Mountain, Burro Mountain, Chloride Flat, Fierro, Fleming, Georgetown, Hanover, Lone Mountain, Pinos Altos, and Santa Rita see Paige, Sidney, U. S. Geol. Survey Geol. Atlas U. S., Silver City folio (No. 199), 1916.

[6] Paige, Sidney, Copper Deposits of the Tyrone District, N. Mex.: U. S. Geol. Survey Prof. Paper 122, 1922.

The Black Hawk Consolidated Mines Co. concentrator[7] continued operations in 1930, treating not only zinc-lead-copper-silver-gold sulphide ore from its "Combination" mine but also similar ore from the Ground Hog unit of the Asarco Mining Co., several cars of nearly similar ore from Magdalena, and a small lot from the Georgia Gold Mines of Pinos Altos. The equipment of this selective flotation mill (originally completed in August, 1928, and described in the 1929 report of this series) was increased in 1930 by the addition of 3 Southwestern Engineering Works flotation machines and 1 Dorr thickening tank; the full capacity of the mill is 175 tons in 24 hours; the average treated daily when the mill was running in 1930 was 160 tons. The Black Hawk Consolidated Mines Co. also shipped lead-silver ore from its Lucky Bill mine to the El Paso smelter.

The Asarco Mining Co. (Ground Hog unit) during the first four months of 1930 also shipped zinc-lead-silver-copper-gold sulphide ore to the No. 1 unit of the Peru selective flotation mill at Wemple 3½ miles from Deming and during the year shipped copper-silver oxidized ore and lead-copper-silver sulphide ores to the El Paso smelter. The No. 2 unit of the Peru mill was operated 350 days on lead-free zinc ore from its mine at Hanover. The equipment of the Peru mill is given in the 1929 report of this series.

The Empire Zinc Co. 300-ton flotation mill at Hanover continued to treat run-of-mine zinc sulphide ore from its Hanover mine in 1930. The zinc concentrates produced were shipped chiefly to the company plant at Canon City, Colo., but also were sent to the company plants at Depue, Ill., and Palmerton, Pa.

The Hanover Bessemer Iron & Copper Co. and lessees shipped siliceous iron-copper oxidized ore and magnesium-lime-siliceous copper sulphide ore from Fierro[8] to the El Paso smelter in 1930. The company also shipped 173,432 gross tons of combined crude and beneficiated magnetite ore, chiefly to the Colorado Fuel & Iron Co. at Pueblo, Colo.

The Nevada Consolidated Copper Co., Chino Mines division, operated its 13,500-ton flotation mill at Hurley for 331 days at an average daily rate of 7,594 tons; the ore treated totaled 2,513,560 tons. The ore is mined from open pits by steam and electric shovels. The ore bodies occur in highly altered porphyry and sediments under an overburden whose thickness ranges from nothing to 150 feet. The ore itself has a maximum thickness of 600 feet and is about 300 feet thick near the pit margins.[9] In 1930 prospect drilling of the ground to the south of the Sierra ore body was continued throughout the year, and 26 drill holes were completed. The additional tonnage susceptible to power-shovel mining (disclosed by the drilling campaign begun in August, 1929) has practically doubled that class of reserves and rendered any further preparation for underground mining at this time unnecessary; all work for this purpose, both surface and underground, has been stopped.

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[7] See Wright, I. L., Milling Methods and Costs at the Black Hawk Concentrator, Hanover, N. Mex.: Information Circ. 6359, Bureau of Mines, 1930, 15 pp.

[8] Paige, Sidney, The Hanover Iron-Ore Deposits, N. Mex.; Contributions to Economic Geology, 1908, Part I: U. S. Geol. Survey Bull. 380, 1908, pp. 199-214.

[9] See Thorne, H. A., Mining Practice at the Chino Mines, Nevada Consolidated Copper Co., Santa Rita, N. Mex.: Information Circ. 6412, Bureau of Mines, 1931, 28 pp.

The Twenty-Fourth Annual Report of the Nevada Consolidated Copper Co., for the year ended December 31, 1930, contains the following statement concerning the operations of the Chino Mines division and the revenue and costs of the combined Nevada, Ray, and Chino divisions:

> *Exploration and ore reserves.*—At Chino Mines prospect drilling of the ground to the south of the Sierra ore body was continued throughout the year, and 26 drill holes were completed. The additional tonnage of ore disclosed by this drilling campaign, which was commenced in August, 1929, is estimated at about 60,000,000 tons, of which 50,000,000 tons were susceptible to power shovel mining.
>
> No complete recomputation of ore reserves was made at any division, but the total of commercial grade remaining at the end of the year [for the three properties] is estimated at well above 300,000,000 tons.
>
> *Development and improvements at the mines.*—At Chino Mines the development of a large tonnage of additional shovel ore resulted in practically doubling that class of reserve and has rendered unnecessary any further preparation for underground mining at this time; and all work for this purpose, both surface and underground, has been stopped. During the year some of the underground drifts were extended to the east in order to check drill-hole results and to furnish additional information as to the tonnage of the newly discovered ore that could be more cheaply removed by power shovels.
>
> *Mining operations.*—At Chino Mines, where all ores were mined by power shovels, the mining cost for the year, exclusive of depreciation and taxes but including all other expenses, was 33.40 cents per ton. The mining costs stated above do not include the usual charge, made at all mines against each ton of ore produced, for prepaid development, stripping expense, or both. This charge for the year was, at Chino Mines, 45 cents per ton.
>
> *Construction and improvements at the mills.*—At Chino Mines major improvements of the Hurley concentrator were completed early in the year, bringing to a close a campaign of remodeling which has been in progress for several years. All the changes made have proved to be in every way satisfactory, and the concentrator as now arranged is a thorougly modern and up-to-date plant, with a capacity of approximately 15,000 tons a day. In spite of a reduction in the daily tonnage treated, milling costs for the year show a decrease of 4.5 cents a ton below last year's performance * * *.
>
> *Milling operations in 1930.*—At Chino Mines a total of 2,513,560 dry tons of ore was milled through the Hurley concentrator during the year, equivalent to a daily average of 6,886 tons. The cost of milling, exclusive of depreciation and taxes, but including all other expenses, was 54.53 cents per ton.
>
> *Smelting operations.*—As to Chino Mines, the concentrates produced from the mills and all direct smelting ores obtained from mining operations were smelted at the plant of the American Smelting & Refining Co. at El Paso, Tex.
>
> *Nevada Consolidated Copper Co.'s production in 1930.*—The total quantity of ore delivered from the Nevada, Ray, and Chino mines and treated during the year was 7,727,388 tons. Of this total 7,610,131 tons, equivalent to a daily average of 20,850 tons, were treated at the concentrators, and 117,257 tons of crude ore were shipped direct to the smelters.
>
> In addition to the company ores as above stated, 1,076,005 tons of contract and other custom ores were milled, and 52,237 tons smelted at the Nevada plant.
>
> The average grade of all company material milled was 1.213 per cent copper, and the average recovery in the form of concentrates was 86.66 per cent of the total copper contents.
>
> The year's total net production of company copper from both concentrating and direct smelting ore was 141,980,173 pounds, as compared with a production of 266,274,918 pounds for the previous year.
>
> *General.*—At Chino Mines the electrification of the shovel equipment is practically finished. One steam shovel was converted to electric during the year, making a total of eight electric shovels now in commission, of which seven are of the standard type, mounted on caterpillars, and one is of the revolving type. Two more steam shovels will be converted as required to provide the division with a sufficient number of electric shovels for full-capacity operation. The work of raising five boiler units at the Hurley power plant was completed early in the year, and no further expenditures at the power plant are at present necesssary.

Statement of operations of the Nevada Consolidated Copper Co. for the year ended December 31, 1930

Operating revenues:		
Copper produced—141,980,173 pounds at 12.207 cents		$17, 331, 434. 19
Gold produced—29,165.203 ounces at $20.667		602, 755. 26
Silver produced—123,745.959 ounces at 36.032 cents		44, 588. 18
		17, 978, 777. 63
Operating expenses:		
Mining, including stripping and development charge	$6, 582, 154. 46	
Ore delivery—mine to mill	1, 050, 622. 48	
Milling	3, 740, 500. 09	
Treatment, freight, and refining	4, 030, 780. 76	
Selling commission	177, 679. 00	
		15, 581, 736. 79
Profit from operations		2, 397, 040. 84
Miscellaneous income—net		1, 316, 589. 61
Total income		3, 713, 630. 45
Charges against income:		
Depreciation	$1, 792, 579. 65	
Plant and equipment retirements	60, 317. 68	
		1, 852, 897. 33
Net income to surplus		1, 860, 733. 12
SURPLUS FROM OPERATIONS		
Balance—Dec. 31, 1929		22, 792, 427. 82
Net income for year (without deduction for depletion)		1, 860, 733. 12
		24, 653, 160. 94
Charges against surplus for inventory and metal adjustments, etc.—net	$4, 128, 143. 34	
Distributions to shareholders	7, 893, 056. 92	
		12, 021, 200. 26
Balance—Dec. 31, 1930		12, 631, 960. 68

Other producing mines in the Central district were the Copper Flat, Hanover-Modoc of the Phelps Dodge Corporation, Davidson, Minter, San Jose, and Silver King.

Mine production of gold, silver, copper, lead, and zinc in Central district, Grant County, N. Mex., 1921–1930, in terms of recovered metals

Year	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1921	362, 331	$10, 439	9, 688	9, 138, 442	4, 422	95, 000	$1, 203, 935
1922	1, 426, 783	24, 537	11, 326	28, 408, 184	352, 640	1, 333, 440	3, 966, 369
1923	2, 885, 711	68, 108	29, 264	54, 374, 770	1, 311, 141	13, 017, 000	9, 062, 131
1924	2, 859, 688	71, 121	38, 200	66, 824, 015	1, 183, 626	16, 921, 000	10, 045, 216
1925	3, 159. 167	97, 299	76, 547	68, 812, 280	2, 363, 260	15, 033, 000	11, 269, 879
1926	3, 633, 821	109, 335	86, 963	75, 219, 200	2, 611, 100	14, 327, 000	11, 977, 701
1927	3, 087, 823	98, 963	85, 963	66, 971, 008	1, 907, 476	10, 076, 000	9, 685, 941
1928	3, 723, 753	113, 507	143, 993	80, 238, 820	2, 359, 155	15, 089, 000	12, 809, 303
1929	4, 135, 864	131, 631	374, 398	87, 445, 648	7, 532, 318	22, 448, 000	17, 677, 723
1930	2, 667, 267	77, 110	407, 608	57, 243, 200	7, 872, 000	30, 638, 000	9, 539, 879

Chloride Flat district (*Silver City*).—Shipments of iron-manganese ore[10] from the Chloride Flat district in 1930 totaled 14,427 gross tons.

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[10] Jones, E. L., jr., Deposits of Manganese Ore in New Mexico; Contributions to Economic Geology, 1919, Part I: U. S. Geol. Survey Bull. 710, 1920, pp. 37–60; Wells, E. H., Manganese in New Mexico: New Mexico State School of Mines Bull., 1918.

Eureka (Hachita) district (see also Eureka district, Hidalgo County).—A 40-ton car of lead-silver-gold ore was shipped by Alvin Latham to the Copper Queen lead plant, Douglas, Ariz.

Gold Hill district.—A small lot of lead-silver-gold smelting ore was shipped in 1930 from the Good Luck group.

Pinos Altos district.[11]—Shipments in 1930 from lode mines at Pinos Altos consisted of a small car of lead-silver-gold ore from the Georgia and a small lot of gold-silver-copper ore from the Three Brothers sent to El Paso, and a small lot of gold-silver bullion from a clean-up at the Graham mill sent to the Denver Mint. Surface deposits at Pinos Altos yielded, by hand rockers and pans, 83.84 crude ounces of placer gold which upon melting at the Denver Mint were reduced to 77.68 crude ounces averaging 0.741 in gold fineness and 0.223 in silver fineness.

Steeple Rock district (16 miles east of Duncan, Ariz.).—A 50-ton shipment of gold and silver ore was made to the El Paso smelter from the Norman King mine.

Swartz (or Carpenter) district (28 miles east of Santa Rita).—In August, 1929, the Asarco Mining Co., Black Range unit, returned the Royal John mine and mill to the owner. In 1930 A. L. Owen operated the mill for a short time, producing several hundred tons each of lead and zinc concentrates. The equipment of the mill is given in the 1929 report of this series.

GUADALUPE COUNTY

Owing to the low price of copper I. J. Stauber, who had been shipping copper ore for several years from a surface deposit in secs. 6 and 7, T. 7 N., R. 20 E. of the New Mexico Principal Meridian, suspended operations on August 20, 1930. The mine is developed by shallow shafts averaging 27 feet in depth; the ore is oxidized; the minerals are malachite and azurite. In 1930 the total quantity shipped was 10,123 tons averaging 4.89 per cent copper.

HIDALGO COUNTY

Eureka district (Hachita) (see also Eureka district, Grant County).—In 1930 the Continental Mining Co. shipped a 1-ton lot of siliceous copper-silver oxidized ore and a 14-ton lot of siliceous lead-silver oxidized ore to the El Paso smelter. J. N. Clark shipped an 8-ton lot of lead-silver ore to the El Paso smelter from the Lead Queen group.

Gillespie (or Red Hill) district (Hachita).—In 1930 the Phelps Dodge Corporation and other lessees shipped several cars of lead-silver-gold ore from the Red Hill mine 28 miles south of Hachita.

Lordsburg district (including Pyramid and Virginia or Shakespeare districts).—Shipments of highly siliceous gold-silver-copper ore to smelters at Douglas, Ariz., and El Paso, Tex., were greater in 1930 than in 1929.

The Eighty-Five mine, a subsidiary of the Calumet and Arizona Mining Co., was operated by 2 shifts 6 days a week for the entire year, except for 16 days when ore was not hoisted on account of shaft repairs. In 1930 development at this mine was as follows: Sinking, 648.5 feet; drifting, 7,287.5 feet; raising, 1,399 feet; and stations, 9,355 cubic feet. Since May 1, 1920, the date of purchase by the Calumet & Arizona Mining Co., development has been: Drifts and crosscuts, 44,947 feet; raises, 11,746 feet; and stations, 132,000 cubic feet. The mine is opened by two vertical shafts, 1,850 and 1,743 feet deep. In 1930 shipments of siliceous copper-gold-silver ore to the C. and A. smelter at Douglas, Ariz., totaled 75,989 tons. The ore averages: Silica, 65 per cent; iron, 7 per cent; and sulphur, 5 per cent.

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[11] Paige, Sidney, The Ore Deposits near Pinos Altos, N. Mex.: Contributions to Economic Geology, 1910, Part I: U. S. Geol. Survey Bull. 470, 1911, pp. 109–125.

Other producers in 1930 were the Anita Copper Co. (Lucy, McGinty, Octo Nos. 1 to 9, and Ontario claims), the Alamo Mining Co. (Henry Clay claim), Bonney-Shoofly, Last Chance (lead-silver-gold ore), Miser's Chest, Robert E. Lee, and Ruth (lead-silver-gold ore).

Mine production of gold, silver, copper, and lead in Lordsburg district, Hidalgo County, N. Mex., 1921–1930, in terms of recovered metals

Year	Ore	Gold	Silver	Copper	Lead	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	
1921	11, 593	$22, 987	35, 119	579, 295	13, 134	$133, 426
1922	61, 291	114, 911	107, 511	3, 216, 585	102, 291	662, 287
1923	96, 587	216, 554	141, 538	4, 314, 122	46, 185	970, 024
1924	88, 472	192, 203	113, 591	4, 927, 878	40, 412	917, 094
1925	108, 219	222, 823	126, 781	5, 064, 140	69, 700	1, 035, 981
1926	97, 420	241, 954	126, 909	4, 762, 750	73, 400	993, 802
1927	93, 406	197, 333	77, 155	3, 933, 496	46, 381	759, 290
1928	91, 289	217, 548	104, 653	4, 625, 347	19, 638	945, 959
1929	83, 091	219, 359	159, 163	4, 248, 193	59, 080	1, 055, 597
1930	102, 317	289, 823	189, 070	4, 857, 300	88, 300	998, 479

San Simon district (*Steins*).—The flotation mill, built in 1927–28 at the Carbon Hill holdings and operated during parts of 1928–29, was operated for a short time in 1930. The product was lead-silver concentrates. Before relinquishing the lease in February, 1930, the Phelps Dodge Corporation shipped about 100 tons of lead-silver smelting ore from the Bradford prospect, which includes the Silver Hill group, 10 miles south of Steins.

LINCOLN COUNTY

Nogal district.—A 3-ton lot of lead-silver ore was shipped in 1930 from the Crow group to the El Paso smelter.

Red Cloud or Gallinas Mountains district.—The Real Del Monte Metals Co., owner of the Conqueror claim and lessee of the Deadwood-Red Cloud group, in 1930 carried on general reconditioning and small-scale development and shipped 23 tons of lead-silver ore to the El Paso smelter.

Whiteoaks district.—Sampling of the dumps of the old North & South Homestake mines resulted in shipment of a 1-ton lot of gold ore to the El Paso smelter.

LUNA COUNTY

Deming district.—The 2-unit Peru selective flotation mill was operated in 1930, chiefly on Central district, Grant County, ores (see p. 803).

Florida Mountains district.—A 1-ton lot of lead-silver ore was shipped to the El Paso smelter from the Edna Bell claim.

Tres Hermanas district[12] (*Columbus*).—A 23-ton lot of lead-silver-gold sulphide ore was shipped to the El Paso smelter from the Dorothy group.

Victorio district (*Gage*).—A lessee on the Chance group shipped 350 tons of lead-silver-gold ore to the El Paso smelter.

OTERO COUNTY

High Rolls (Sacramento Mountains) district.—In the course of location, annual assessment, and development work on many claims 9.9 miles from High Rolls the Adycupb Co. mined and shipped for test purposes 1 car of copper-silver ore from the Juniper (formerly the Courtney). The properties are developed by incline shafts 50 to 1,500 feet deep. In 1930 the company operated 340 days, and the work consisted of driving the main shaft 834 feet deep and driving 19 incline shafts with a total aggregate length of 1,018 feet; moreover, numerous open cuts and vertical 10-foot shafts were dug. Stewart & Holmes shipped 1,112 tons of siliceous lead-silver-copper ore to the El Paso smelter from the Alamo group 7.6 miles southwest of High Rolls. The development on this property at the end of 1930 was reported to be 1,100 feet of adits, 1,300 feet of drifts, and a 600-foot incline shaft. Approximately 400 feet of development work were done in 1930. Other producers in the district in 1930 were Morrison & Toheny and McNeil & King, each of which shipped small lots of copper-silver ore to the El Paso smelter.

Orogrande district.—Lessees on the By Chance, Cuprite, Gem, and Molly Gibson claims at Orogrande shipped 490 tons of copper-silver-gold ore to the El Paso smelter in 1930.

Tularosa district.—A. T. Quirl shipped a 1-ton lot of copper ore from a prospect near Tularosa to the El Paso smelter.

SANDOVAL COUNTY

Cochiti (*Bland*) *district.*—The development work begun in 1929 at the Lone Star and Crown Point groups in the Cochiti district ceased August 1, 1930. The district formerly produced silver; the last year of production was 1916.

SAN MIGUEL COUNTY

Willow Creek district (*Tererro*).—The American Metal Co. of New Mexico in 1930 operated its 600-ton selective flotation mill at approximately three-fourths capacity throughout the year. The mill (first set in motion on January 20, 1927) is in Alamitos Canyon 6 miles by road from Glorieta station and 4 miles by railroad spur from Fox station on the Atchison, Topeka & Santa Fe Railway; it is connected with the mine (called the Pecos mine[13]) by a 12-mile aerial tram. In 1930 the main vertical shaft of the mine was sunk 129 feet, making the total depth 966 feet.

The actual heads of ore into the mill in 1930 averaged 0.107 ounce gold, 3.37 ounces silver, 4.93 per cent lead (wet assay), 0.83 per cent copper (wet assay), and 15.41 per cent zinc. From 151,943 dry tons treated in 1930 were made 36,815 tons of zinc concentrates—averaging 0.036 ounce gold, 3.05 ounces silver, 1.63 per cent lead (wet assay), 1 per cent copper (wet assay), 54.45 per cent zinc, 6.99 per cent iron, and 32.18 per cent sulphur—and 15,959 tons of lead-copper concentrates—averaging 0.768 ounce gold, 19.98 ounces silver, 37.81 per cent lead (wet assay), 4.02 per cent copper (wet assay), 13.47 per cent zinc, 11.47 per cent iron, and 24.31 per cent sulphur. The equipment of the mill was described in the 1929 report of this series.

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[12] Lindgren, Waldemar, The Tres Hermanas Mining District, N. Mex.; Contributions to Economic Geology, 1908, Part I: U. S. Geol. Survey Bull. 380, 1908, pp. 123-128.

[13] Stott, C. E., Geology of the Pecos Mine: Eng. and Min. Jour., Mar. 23, 1931, pp. 270-275; Matson, J. T., and Hoag, C., Mining Practice at the Pecos Mine of the American Metal Co. of New Mexico: Information Circ. 6368, Bureau of Mines, 1930, 21 pp.

The lead-copper concentrates were shipped in 1930 to the American Smelting & Refining Co. lead plant at El Paso. The zinc concentrates were shipped to the Blackwell Zinc Co. (American Metal Co.) natural-gas retort plant at Blackwell, Okla., and to the American Zinc & Chemical Co. (American Metal Co.) at Langeloth, Pa. Zinc residues from Blackwell went to El Paso, Tex., and from Langeloth to Chrome, N. J.

The following table shows the total output of San Miguel County, all of which has come from the Pecos mine.

Mine production of gold, silver, copper, lead, and zinc in San Miguel County, N. Mex., 1927–1930, in terms of recovered metals [1]

Year	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1927	164,874	$235,766	509,446	1,989,000	8,706,000	42,445,000	$4,050,139
1928	201,013	309,697	495,930	2,120,000	10,385,000	46,410,000	4,338,436
1929	216,809	343,064	471,619	2,641,000	11,439,000	45,730,000	4,798,090
1930	151,943	271,127	406,865	1,438,000	10,861,000	33,276,000	2,755,008
Total[1]	734,639	1,159,654	1,883,860	8,188,000	41,391,000	167,861,000	15,941,673

[1] Figures represent total output of San Miguel County—all from the Pecos mine.

SANTA FE COUNTY

Los Cerrillos district.—No ore was shipped in 1930 from the Los Cerrillos district. At the Bottom Dollar property the shaft was sunk 20 feet, making the total 170 feet. The Evelyn Gold Copper group, a producer in 1929 and years immediately prior, was idle in 1930.

New Placers district (*Golden, San Pedro*).—Lessees on the dumps of the San Pedro mine shipped 365 tons of copper-silver-gold ore to the El Paso smelter. The 50-ton amalgamation mill of the Argo Mining & Milling Co. was operated for a short time, and gold bullion averaging 0.655¼ gold fineness and 0.131½ silver fineness was shipped to the Denver Mint. A small bar of gold bullion was shipped from the Delgado mine to the Denver Mint; it averaged 0.962¼ gold fineness and 0.033½ silver fineness.

Placer mines in the San Pedro district in 1930 yielded only 6.81 crude ounces of gold bullion, which after being melted at the Denver Mint weighed 6.45 ounces, containing 6.15 fine ounces of gold. Fineness of gold was 0.953½ and that of silver 0.038½.

SIERRA COUNTY

Apache, Cuchillo Negro district (*Chloride*).—Ten miles west of Chloride the Velie Metals Co. in 1929–30 built a 100-ton flotation mill to treat the silver-copper ore of the Silver Monument mine and in 1930 operated the mill for about 6 months. The high-grade silver-copper concentrates produced were hauled 90 miles southeast to Hatch station on the Atchison, Topeka & Santa Fe Railway, thence by railroad to the El Paso smelter. The equipment of the Silver Monument mill consists of 1 Blake jaw crusher, 1 Telsmith gyratory crusher, one 4 by 10 foot tube mill, 1 Dorr Simplex classifier, 2 Forrester flotation machines, 1 Oliver filter, and 1 Dorr 18-foot thickener tank.

Lake Valley district.—H. E. Mason shipped 1 car of dry silver ore to the El Paso smelter.

Las Animas district (Hillsboro).—In 1930 production from the Hillsboro district consisted of the following shipments to the El Paso smelter: One car of gold-silver-copper ore from the Empire-Bonanza; a 1-ton lot of gold ore from the Garfield; a 3-ton lot of gold ore from the Sherman; and 2 cars of copper-silver-gold ore from the Snake and Opportunity group.

SOCORRO COUNTY

Good Fortune district (40 miles west of Tularosa).—One car of copper-silver ore was shipped to the El Paso smelter from the Bella Vista prospect; the property is opened by a 400-foot adit.

Hansonberg district (17 miles southeast of Carthage).—The abandoned Escaprosa claim was relocated in 1930, and 2 cars of copper-silver ore were mined and shipped to the El Paso smelter.

Magdalena district (Kelly, Magdalena).—A lessee on the Empire Zinc Co. Kelly mine shipped 1,000 tons of lead-copper-silver oxidized ore to the El Paso smelter and 3,400 tons of zinc-lead sulphide ore to the leaded-zinc oxide plant at Coffeyville, Kans. J. A. McDonald shipped lead-silver ore from the Juanita and several types of ore from the Nitt group; the copper-silver sulphide ore and lead-silver sulphide ore went to the El Paso smelter, and zinc-lead-silver sulphide ore went to the Combination custom flotation mill at Hanover, N. Mex.

Mine production of gold, silver, copper, lead, and zinc in Magdalena district, Socorro County, N. Mex., 1921–1930, in terms of recovered metals

Year	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons		*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1921	412		155		60,711	133,000	$9,537
1922	8,304	$207	6,156	8,063	923,541	3,119,298	236,046
1923	10,117	455	15,721	50,388	1,506,829	3,421,000	358,859
1924	11,128	199	10,643	94,626	1,636,825	3,823,800	399,219
1925	12,356	1,154	25,073	82,800	2,434,600	3,170,000	483,042
1926	43,414	606	14,575	56,714	1,400,200	8,013,300	730,654
1927	41,702	775	70,478	173,817	1,637,667	4,430,000	450,199
1928	6,798	1,980	16,183	128,327	991,207	339,000	108,095
1929	5,726	285	15,032	174,483	961,270	254,000	116,330
1930	5,805	109	7,426	50,100	958,600	1,470,000	127,971

Salinas Peak district.—The development begun in 1929 at the Salinas Chief group in the Salinas Peak district was continued in 1930; 2 cars of lead-silver ore were shipped to the El Paso smelter.

TAOS COUNTY

Red River district.—Development work only was done in 1930 at the Silver King group of the Buffalo-New Mexico Mines Co. on Placer Creek. At the various other prospects in the district—Claribel, Gold Roof-Gold Ledge-Sylvia, Golden Treasure, Independence, Last Chance-Lulu-Mamie-Stella, Memphis, Silver Tip, and Willard—only necessary assessment work was reported.

Sulphur Creek district.—The Molybdenum Corporation of America continued to mill molybdenum ore from the Phyllis group at the 35 to 40 ton flotation mill at the junction of Sulphur Creek and Red River above Questa.

TORRANCE COUNTY

In 1930 only 120 tons of ore, containing 3.93 per cent copper and 0.5 ounce silver to the ton, were shipped from shallow ore bodies in the "Red Beds" near Scholle; in 1929 the output was 2,001 tons containing 4.18 per cent copper and 0.70 ounce silver to the ton.

VALENCIA COUNTY

In 1930 lessees shipped 57 tons of ore containing 6.05 per cent copper and 1 ounce silver to the ton from property west of Grant.

GOLD, SILVER, COPPER, AND LEAD IN TEXAS [1]

(MINE REPORT)

By Chas. W. Henderson

CONTENTS

	Page
Summary	813
Review by counties	814
Burnet County	814
Culberson County	814
El Paso County	814
Hudspeth County	814
Presidio County	815

SUMMARY

The mine production of gold, silver, copper, and lead in Texas from 1921 to 1930 is shown in the following table. The total production of gold in Texas from 1885 to 1930, inclusive, according to Henderson,[2] is $95,073, and that of silver is 22,772,523 ounces.

Mine production of gold, silver, copper, and lead in Texas, 1921–1930, in terms of recovered metals

Year	Ore (short tons)	Gold	Silver		Copper		Lead		Total value
			Fine ounces	Value	Pounds	Value	Pounds	Value	
1921	58,527	--------	516,766	$516,766	--------	--------	--------	--------	$516,766
1922	69,420	--------	644,980	644,980	4,290	$579	8,016	$441	646,000
1923	78,610	$802	811,824	665,696	4,257	625	26,605	1,862	668,985
1924	84,744	--------	720,739	482,895	--------	--------	--------	--------	482,895
1925	72,737	--------	552,000	383,088	--------	--------	16,000	1,392	384,480
1926	34,042	2,270	447,237	279,076	12,620	1,767	83,890	6,711	289,824
1927	50,759	8,192	1,034,866	586,769	21,458	2,811	487,984	30,743	628,515
1928	76,915	10,115	1,340,622	784.264	447,792	64,482	695.570	40,343	899,204
1929	63,872	26,439	1,020,516	543,935	341,000	60,016	849,683	53,530	683,920
1930	31,147	3,648	389,239	149,857	143,100	18,603	396,820	19,841	191,949

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed April, 1932.

[2] For production from 1885 to 1927 and prices used in calculating values see Henderson, Chas. W., Mineral Resources, 1927, Pt. I, pp. 477 and 478. *See also* Henderson, Chas. W., Mineral Resources, 1914, Pt. I, p. 236.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

REVIEW BY COUNTIES

BURNET COUNTY

In 1930 the Frank Pavitte Mining Co. treated 736 tons of lead sulphide ore in its 35-ton concentrating mill; the product, 29 tons of lead concentrates, averaged 66.45 per cent lead. The mill is equipped with 1 Freeman jaw crusher, 1 circular screen, and 2 Webb City 24-inch rolls. The mine is on Silver Creek 18 miles northwest of Burnet.

CULBERSON COUNTY

From May 1 to October 1, 1930, the World Exploration Co. operated its new 100-ton flotation mill at the Hazel mine at a daily rate of 31 tons. A total of 4,616 tons of ore was treated and yielded 238 tons of copper-silver concentrates carrying 23,260 ounces of silver and 102,587 pounds of copper. No new development work was done in 1930. The equipment of the mill is as follows: 2 Sturtevant 10 by 15 inch crushers, 1 Colorado Iron Works 6 by 6 foot ball mill, 1 Dorr duplex 5½ by 18 foot classifier, 3 MacIntosh (10-foot by 9-inch Rotors) flotation machines, 1 Oliver 5½ by 4 foot filter, and 1 Dorr 10-foot and 1 Dorr 42-foot thickening tank. The mine is 14 miles north of Van Horn.

EL PASO COUNTY

At El Paso are the lead and copper plants of the American Smelting & Refining Co. Natural gas for fuel was introduced at these plants in 1930.[3]

The Nichols electrolytic copper refinery, also at El Paso, was completed and set in operation in 1930 to treat copper anodes produced at the Arizona smelters of the Phelps Dodge Corporation and the Calumet and Arizona Mining Co. The yearly capacity is 100,000 tons of anodes.[4]

HUDSPETH COUNTY

Allamoore district.—From the Black Shaft mine 8 miles northeast of Allamoore 734 tons of smelting ore were shipped in 1930, carrying

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[3] Marble, E. R., Natural Gas Firing at El Paso Smelting Works: Min. and Met., October, 1930, pp. 466–467.

[4] Robie, E. H., A Trip Through the New Nichols Copper Refinery at El Paso, Tex.: Eng. and Min Jour., vol. 129, January, 1930, pp. 5–10; Furnace and Casting Equipment of the New Nichols Refinery: Eng. and Min. Jour., vol. 129, January, 1930, pp. 73–76. Corwin, F. R., and Harloff, C. S., El Paso Refinery of the Nichols Copper Co.: Min. and Met., October, 1930, pp. 459–465.

411 ounces of silver and 46,059 pounds of copper. From the Mohawk mine 76 tons of silver-copper-lead ore were shipped.

Sierra Blanca district.—The Bonanza mine and mill were not operated in 1930.

PRESIDIO COUNTY

The American Metal Co., operator of the famous Presidio mine since April, 1926, closed the property June 30, 1930, owing to the declining price of silver. Production in 1930 consisted of silver cyanide precipitates and lead-silver concentrates. A brief history of the operations at this property was given in the 1929 report of this series.

The following table shows the total number of tons treated, silver content of mill heads (per ton and total), and recovery of silver (percentage and total).

Production of silver from the Presidio mine,[1] 1885–1930

Period	Mill heads treated (short tons)	Silver content of mill heads (ounces)		Recovery of silver	
		Per ton	Total	Per cent	Ounces
1885–1912	450,000	25.84	11,628,000	81.68	9,497,750
1913–1926	720,000	12.00	8,640,000	83.66	7,228,224
1927	48,190	22.87	1,102,105	[2]91.41	[2]1,004,384
1928	57,475	23.17	1,331,696	91.04	1,212,340
1929	54,644	19.74	1,078,673	90.30	974,049
Total, 1885–1929	1,330,309	17.88	23,780,474		19,916,747
1930	24,985	(?)	(?)	(?)	365,439
Total, 1885–1930	1,355,294	(?)	(?)	(?)	20,282,186

[1] Howbert, Van Dyne, and Gray, F. E., Milling Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng., Tech. Pub. 368, 1930; Howbert, Van Dyne, and Bosustow, Robert, Mining Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng., Tech. Pub. 334, 1930.

[2] Using the company's 1927 report of 1,004,384 ounces of silver recovered gives 91.13 per cent recovery; using 91.41 per cent (Howbert and Gray, work cited, p. 6) as recovery gives 1,007,434 ounces of silver recovered.

As recoveries were doubtless about the same in 1930 as in 1929, the table from the report of this series for 1929 is repeated here.

Average mill recoveries (per cent), Presidio mine, in 1929

Product	Weight	Recovery[1]		
		Silver	Gold	Lead
Heads	100.00	100.00	100.00	100.00
Tails	98.05	9.70	3.00	65.70
Precipitates	.10	62.60	57.50	1.50
Concentrates	1.85	27.70	39.50	32.80
Precipitates plus concentrates	1.95	90.30	97.00	34.30

[1] Recoveries include corrections based on smelter returns.

GOLD AND SILVER[1]

(GENERAL REPORT)

By J. P. Dunlop

CONTENTS

Page
Domestic production — 817
Prices of silver — 819
Imports and exports — 820
Domestic supply — 820
World production — 821
  Gold — 821
  Silver — 822
Mine report — 824
  Method of collecting statistics — 824
  Units of measurement — 824
  Mines producing — 825
    Leading gold producers — 825
    Leading silver producers — 826
    Number of mines — 827
  Mine production — 828
    Summary — 828
    Ore production, classification, and average value — 829
    Gold, by sources — 833
      Placers — 834
        General features — 834
        Dredging — 835
      Dry and siliceous ores — 836
      Copper ore — 838
      Lead ore — 838
      Zinc, lead-zinc, and mixed ores — 838
    Silver, by sources — 839
      Placers — 840
      Dry and siliceous ores — 840
      Copper ore — 840
Page
Mine report—Continued.
  Mine production—Continued.
    Silver, by sources—Continued.
      Lead ore — 841
      Lead-zinc ore — 841
      Zinc and mixed ores — 841
    Gold and silver, by methods of treatment — 842
      Quicksilver and cyanide used — 847
    Review by States — 848
      Alaska — 848
      Arizona — 849
      Arkansas, Missouri, Oklahoma, Illinois, and Kentucky — 850
      California — 850
      Colorado — 851
      Idaho — 851
      Michigan — 852
      Montana — 852
      Nevada — 853
      New Mexico — 853
      Oregon — 854
      South Dakota — 854
      Southern Appalachian and Eastern States — 854
      Texas — 855
      Utah — 855
      Washington — 856
      Wyoming — 856
      Philippine Islands — 856
Acknowledgments — 857

DOMESTIC PRODUCTION

Approximate distribution of the production of gold and silver in the United States in 1930, by producing States and Territories

[Figures supplied by the U. S. Bureau of the Mint]

State or Territory	Gold		Silver		Increase or decrease from 1929		
	Fine ounces	Value [a]	Fine ounces	Value [b]	Gold	Silver	
						Fine ounces	Value
Alabama	10	$200					
Alaska	407, 356	8, 420, 800	392, 024	$150, 929	+$675, 700	−86, 949	−$104, 364
Arizona	148, 681	3, 073, 500	4, 910, 394	1, 890, 502	−1, 290, 500	−2, 929, 927	−2, 288, 389
California	450, 289	9, 308, 300	1, 434, 126	552, 139	+853, 100	+239, 475	−84, 610
Colorado	218, 258	4, 511, 800	4, 851, 571	1, 867, 855	−41, 900	+435, 733	−485. 787
Georgia	203	4, 200	23	9	+3, 000	+10	−2
Idaho	21, 198	438, 200	9, 710, 150	3, 738, 408	+33, 100	+176, 823	−1, 342, 855
Illinois			1, 896	730		−2, 250	−1, 480
Michigan			10, 720	4, 127		−7, 179	−5, 413
Missouri			187, 548	72, 206		+40, 910	−5, 952
Montana	46, 900	969, 500	8, 596, 966	3, 309, 832	−185, 100	−4, 016, 614	−3, 413, 206
Nevada	140, 220	2, 898, 600	4, 178, 943	1, 608, 893	−387, 000	−567, 807	−921, 125
New Mexico	31, 589	653, 000	1, 160, 374	446, 744	−29, 700	+99, 880	−118, 499
North Carolina	498	10, 300	32, 891	12, 663	+6, 700	+18, 477	+4, 980
Oregon	14, 300	295, 600	9, 816	3, 779	−69, 400	−28, 024	−16, 390
Pennsylvania	610	12, 600	4, 538	1, 747	−2, 800	−1, 078	−1, 246
Philippine Islands	185, 208	3, 828, 600	120, 884	46, 540	+691, 500	+26, 337	−3, 854
South Dakota	406, 297	8, 398, 900	105, 166	40, 489	+1, 942, 500	+20, 701	−4, 531
Tennessee	721	14, 900	85, 533	32, 930	+1, 400	−10, 613	−18, 316
Texas	242	5, 000	468, 736	180, 463	−21, 100	−573, 537	−375, 068
Utah	208, 936	4, 319, 100	14, 451, 266	5, 563, 738	−584, 700	−3, 393, 391	−3, 947, 464
Vermont			4, 512	1, 737		+879	−199
Washington	3, 647	75, 400	29, 853	11, 493	−6, 700	−21, 786	−16, 031
Wyoming	440	9, 100	197	76	+8, 100	+189	+72
	2, 285, 603	47, 247, 600	50, 748, 127	19, 538, 029	+1, 596, 200	−10, 579, 741	−13, 149, 725

[a] Gold valued at $20.67+ a fine ounce.

[b] Silver valued at 38.5 cents a fine ounce. Average New York price of bar silver.

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[1] Work on manuscript completed April, 1932.

The figures in the preceding table were obtained through cooperation between the United States Bureau of the Mint and the Bureau of Mines and were agreed upon after conference and adjustment between the two bureaus. They are therefore final for both.

The totals are based on bullion deposits in the United States mints and assay offices and on returns to the Bureau of the Mint from the smelting and refining companies. The distribution is adjusted by means of information collected by the Bureau of Mines directly from the producing mines and tabulated for the mine reports discussed later. The data for the total production and in part for the distribution are obtained from records of (1) the unrefined domestic gold and silver deposited in the United States mints and assay offices, (2) the domestic gold and silver in fine bars reported by private refineries, and (3) the unrefined domestic gold and silver contained in ore and matte exported for reduction. The last item is very small.

Domestic smelters recovered 1,254,154 fine ounces of gold and 82,104,778 fine ounces of silver from foreign ores and bullion, an increase of 474,570 ounces of gold and a decrease of 1,676,097 ounces of silver compared with the corresponding figures for 1929. As usual in recent years, the foreign ores and bullion came mainly from Mexico, Canada, and Peru.

The value of the new gold used in the arts and manufactures in the United States in 1930 was $15,177,739 (32 per cent of the domestic output of the United States), compared with $24,873,136 in 1929. The quantity of new silver used for such purposes was 26,874,378 fine ounces (53 per cent of the total domestic output), compared with 30,977,559 ounces in 1929. In addition to the new gold used in the arts and industries, $27,511,640 in gold recovered from waste material was also utilized. The total quantity of silver (new and old) used in the arts and manufactures was 36,343,207 ounces (6,016,875 ounces less than in 1929). In addition to the gold and silver derived from foreign and domestic ore and bullion $20,213,623 in gold and 6,413,157 ounces of silver were recovered from old or obsolete jewelry, silverware, dental waste, and other material, including old film. Nearly all of the silver recovered is now handled by private refineries, as the purchases of silver bullion by United States mints and assay offices are confined to the quantity required for subsidiary coinage.

Gold and silver produced in the United States, 1792–1930

[The estimate for 1792-1872 is by R. W. Raymond, commissioner, and for the period since 1872 by the Director of the Mint]

Period	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1792–1847 [1]	1, 186, 977	$24, 537, 000	309, 500	$404, 500
1848–1872	58, 279, 781	1, 204, 750, 000	118, 568, 200	157, 749, 900
1873–1930	162, 014, 072	3, 349, 128, 100	3, 048, 395, 854	2, 346, 671, 217
	221, 480, 830	4, 578, 415, 100	3, 167, 273, 554	2, 504, 825, 617

[1] A careful investigation by Philip B. Bekeart (Soc. California Pioneers Quarterly, Sept. 30, 1924) appears to have definitely fixed Jan. 19, 1848, as the date of the discovery of gold by James W. Marshall at Sutters Mill, Coloma, Eldorado County, Calif., and to have shown that the flakes (not a nugget) found by Marshall are now in the National Museum, Washington, D. C.

The average commercial value per fine ounce of silver for the total recorded domestic production is $0.791.

PRICES OF SILVER

The average monthly prices of fine bar silver in New York in 1930 were as follows:

Price of silver per fine ounce in 1930, by months

January	$0.45331	August	$0.35504
February	.43505	September	.36632
March	.41959	October	.36158
April	.42740	November	.36220
May	.41036	December	.32945
June	.34910		
July	.34636	Average	.38465

Price of silver per fine ounce, 1921–1930 [2]

1921	$1.00	1926	$0.624
1922	1.00	1927	.567
1923	.82	1928	.585
1924	.67	1929	.533
1925	.694	1930	.385

The yearly price of silver showed a fairly regular downward trend—from $1.337 and $1.339 in 1865 and 1866 to $0.507 in 1915. The World War caused the price to advance; the downward trend was steady from 1923 to 1927. There was an increase of about 2 cents an ounce in 1928, followed by a decrease of about 5 cents an ounce in 1929. The average yearly price for 1930 decreased to $0.385; in 1931 the price was as low as 25 cents during the first half of the year, and the average yearly price was about 29 cents an ounce. The value of exports of silver in 1930 was about $29,250,600 less than in 1929. Exports of domestic bullion amounted to 112,897,446 ounces, of which 22,773,893 ounces went to India, 68,651,160 ounces to China, and 7,076,038 ounces to Germany and Great Britain.

More than half the world output of silver is derived from ores valued chiefly for metals other than silver, so that the price of silver has less weight in encouraging the bulk of silver production than that of other metals associated with it. Only about one-third of the world silver output is derived from ores having silver as a highly predominant factor.[3]

Other information relating to the production of silver has been published by the Bureau of Mines.[4]

It has been estimated that 75 per cent of the silver consumed in the world has been employed in money and less than 25 per cent in arts and industries.[5] No recently discovered use of silver has had great economic importance in increasing consumption, but the quantity consumed by the photographic and other chemical industries will probably increase.

Various plans and investigations have been proposed to increase the price and consumption of silver, but so far no definite steps have been taken to effect these ends.

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[2] Average buying price of silver from domestic mines for 1921 to June 2, 1923; average New York price for all silver after that period.

[3] Merrill, Charles White, Economic Relations of Silver to Other Metals in Argentiferous Ores: Econ. Paper 10, Bureau of Mines, 1930, 29 pp.

[4] Merrill, Charles White, Summarized Data of Silver Production: Econ. Paper 8, Bureau of Mines, 1930, 58 pp.

[5] Merrill, Charles White, Consumption of Silver in the Arts and Industries of the United States: Econ. Paper 14, Bureau of Mines, 1932, 18 pp.

IMPORTS AND EXPORTS[6]

Value of gold and silver imported into and exported from the United States, 1929 and 1930, by classes

	Imports	Exports	Excess of—	
			Imports	Exports
1929				
Gold:				
Contained in domestic ore and base bullion		$57,787		$57,787
Contained in foreign ore and base bullion	$17,459,761		$17,459,761	
Domestic bullion refined	28,129,908	109,228,470		81,098,562
Foreign bullion refined	129,962,247	1,372	129,960,875	
United States coin	96,920,998	7,145,173	89,775,825	
Foreign coin	19,175,718	150,124	19,025,594	
	291,648,632	116,582,926	256,222,055	81,156,349
Excess imports over exports			175,065,706	
Silver:				
Contained in domestic ore and base bullion		5,202		5,202
Contained in foreign ore and base bullion	33,487,387		33,487,387	
Domestic bullion refined		62,788,418		62,788,418
Foreign bullion refined	24,994,216	13,515,301	11,478,915	
United States coin	2,068,861	44,131	2,024,730	
Foreign coin	3,389,366	7,054,145		3,664,779
	63,939,830	83,407,197	46,991,032	66,458,399
Excess exports over imports				19,467,367
1930				
Gold:				
Contained in domestic ore and base bullion		43,826		43,826
Contained in foreign ore and base bullion	17,565,829		17,565,829	
Domestic bullion refined	9,465,478	75,452,202		65,986,724
Foreign bullion refined	47,012,149		47,012,149	
United States coin	160,801,740	39,219,063	121,582,677	
Foreign coin	161,208,499	1,252,241	159,956,258	
	396,053,695	115,967,332	346,116,913	66,030,550
Excess imports over exports			280,086,363	
Silver:				
Contained in domestic ore and base bullion		1,546		1,546
Contained in foreign ore and base bullion	21,275,154		21,275,154	
Domestic bullion refined	76,537	43,502,964		43,426,427
Foreign bullion refined	17,825,676	7,392,959	10,432,717	
United States coin	1,810,222	45,076	1,765,146	
Foreign coin	1,773,252	3,214,039		1,440,787
	42,760,841	54,156,584	33,473,017	44,868,760
Excess exports over imports				11,395,743

DOMESTIC SUPPLY

The total excess of imports of gold over exports from 1916 to 1930, inclusive, was $2,025,663,118. The only years since 1916 in which exports of gold exceeded imports were 1919, when the excess was $292,000,000; 1925, when the excess was $134,000,000; and 1928, when the excess was $391,862,000. The large gain in the domestic supply of gold is illustrated best by the following figures, which show the excess of imports over exports: 1916, $530,000,000; 1917, $180,000,000; 1918, $21,000,000; 1920, $95,000,000; 1921, $667,000,000; 1922, $238,000,000; 1923, $294,000,000; 1924, $258,000,000; 1926, $98,000,000; 1927, $6,000,000; 1929, $175,000,000; and 1930, $280,000,000.

The domestic supply of new gold comes chiefly from dry and siliceous ore and from placer gravel worked largely by dredges. These two sources yielded 90.2 per cent of the domestic gold in 1915, 78.5 per cent in 1926, 76.6 per cent in 1927, 75.1 per cent in 1928, 72 per cent in 1929, and 79.86 per cent in 1930. Considerable gold is recovered also from the refining of copper bullion, especially from copper ores produced at mines in Arizona, Nevada, and Utah. The proportionate output from gold ore has tended to decrease as the yield from many of the principal gold camps has declined and that from copper ore has tended to increase; the result is a general net decline in total yield of gold due to the preponderant proportion of the output from placers and from gold and gold-silver ores. The proportionate output of gold from copper ore was 7.2 per cent in 1915, 16.4 per cent in 1926, 17.4 per cent in 1927, 19.3 per cent in 1928, 22.2 per cent in 1929, and 15.57 per cent in 1930. The decline in 1930 is only temporary, and increased production of copper will bring a larger output of gold from copper ore.

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[6] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

In 1930 the domestic supply of new silver came chiefly from copper ore, lead-zinc ore, lead ore, and dry and siliceous silver and silver-gold ores, in the proportion of 28.53, 27.33, 18.40, and 18.32 per cent, respectively, compared with 29.50, 25.71, 19.22, and 18.25 per cent in 1929. In 1915 dry and siliceous ore yielded 36 per cent of the silver, copper ore 26 per cent, lead ore 27 per cent, and lead-zinc ore only 9 per cent. Thus, the largest gain in the output of silver has been from lead-zinc ore and the greatest loss from dry and siliceous ore.

WORLD PRODUCTION

GOLD

The estimated value of the gold produced in the world from 1860 to 1930, inclusive, is $17,514,697,412. In 1930 the estimated production of the world is recorded as $416,751,500, an increase of $13,647,600 over that in 1929. There were increases of about $6,706,600 in 1928, $1,696,700 in 1927, $6,680,600 in 1926, $25,641,400 in 1924, and $48,344,200 in 1923 and decreases of $104,600 in 1925 and $5,281,100 in 1929 with successive annual decreases from 1915 to 1922.

In a Bureau of Mines publication [7] the world production of gold from 1493 to 1927, inclusive, is estimated at approximately 1,003,560,000 ounces, of which 51.5 per cent was produced from 1901 to 1927.

In 1930 the production of the United States increased $904,700 (Philippine Islands excluded); of Mexico, $324,300; of Australasia, $766,500; of the Philippine Islands, $384,100; of Chosen, $456,200; of Yugoslavia, $97,000; and of Belgian Congo, $476,500. The two most important increases in output of gold were made by South Africa, with a gain of $6,284,800, and Canada, with a gain of $3,695,400. (Both of these areas will show a large increase in output in 1931, Canada occupying second place even with the output of the Philippine Islands included with that of the United States.) In 1930 the production of Brazil decreased $220,000; of Peru, $663,300; and of British India, $716,000.

For the last 10 years the mines in the Union of South Africa (Transvaal, Natal, and Cape Colony) have been producing more than half the world's supply of gold. The gold output of Canada is increasing rapidly, and that of Russia may increase slowly. With lower produc-

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Ridgway, Robert H., Summarized Data of Gold Production: Econ. Paper 6, Bureau of Mines, 1929, 63 pp.

tion costs the yield of gold from gold ores and gravels in the United States should increase, for while the output from gravels by dredging in California may decline, production from dredges in Alaska is increasing and was greater than in California in 1930 for the first time. The increased output of gold from siliceous ore and gravels in the United States in 1931 will probably be offset by the much smaller yield from copper and other base ores.

The following table shows the output of gold by countries, as given by the Bureau of the Mint, with slight changes resulting from late information.

World production of gold, 1925–1930

Country	1925	1926	1927	1928	1929	1930
North America:						
Canada	$35, 880, 800	$36, 263, 100	$38, 300, 500	$39, 082, 000	$39, 861, 700	$43, 557, 100
Central America	2, 000, 000	1, 800, 000	1, 500, 000	1, 250, 000	1, 100, 000	1, 200, 000
Mexico	16, 309, 900	15, 972, 300	14, 990, 700	14, 451, 700	13, 535, 900	13, 860, 200
United States [1]	47, 957, 000	46, 276, 300	43, 767, 500	44, 335, 300	42, 514, 300	43, 419, 000
South America:						
Argentina	55, 000	50, 000	20, 000	20, 000	20, 700	20, 700
Bolivia	8, 000	6, 900	5, 000	10, 500	31, 000	340, 700
Brazil	2, 243, 000	2, 110, 800	2, 120, 100	2, 069, 600	2, 219, 800	2, 000, 000
Chile	1, 265, 500	1, 222, 400	1, 240, 300	595, 500	221, 900	344, 900
Colombia	1, 582. 400	1, 481, 300	1, 500, 000	833, 600	1, 000, 000	1, 000, 000
Ecuador	900, 000	1, 291, 700	1, 328, 000	1, 541, 500	1, 391, 800	1, 447, 000
Guiana—						
British	188, 300	134, 700	118, 100	110, 100	132, 000	143, 300
French	831, 400	935, 100	999, 600	839, 700	850, 300	900, 000
Netherland	204, 700	155, 600	158, 800	113, 700	61, 500	81, 600
Peru	2, 433, 800	2, 485, 600	1, 915, 400	1, 383, 000	2, 524, 800	1, 861, 500
Venezuela	631, 400	631, 300	813, 800	997, 600	893, 100	1, 156, 500
Europe:						
Austria	38, 500	27, 200	2, 700	6, 600	------------	------------
Czechoslovakia	156, 800	159, 500	155, 000	143, 500	103, 700	49, 900
France	701, 800	868, 400	930, 400	1, 116, 500	1, 116, 500	1, 116, 500
Germany	120, 900	107, 600	119, 600	112, 300	120, 300	125, 600
Great Britain	------------	------------	------------	2, 700	200	------------
Greece	------------	------------	10, 000	10, 000	10, 000	10, 000
Italy	39, 900	35, 200	44, 500	38, 600	31, 900	35, 600
Rumania	827, 400	1, 150, 400	1, 367, 800	1, 294, 600	1, 470, 800	1, 470, 800
Russia	20, 364, 900	20, 509, 700	21, 931, 800	24, 806, 200	20, 671, 800	20, 671, 800
Spain	20, 000	20, 000	20, 000	15, 000	10, 000	10, 000
Sweden	------------	305, 700	305, 700	289, 400	206, 700	206, 700
Yugoslavia	156, 800	214, 700	256, 500	299, 100	381, 500	478, 500
Asia:						
China	2, 218, 100	2, 273, 900	2, 067, 200	2, 067, 200	1, 033, 600	1, 033, 600
Chosen	3, 035, 100	3, 940, 500	3, 706, 800	3, 440, 000	2, 843, 200	3, 299, 400
East Indies—						
British	500, 000	400, 000	------------	------------	------------	------------
Netherland	2, 743, 500	2, 384, 600	2, 337, 400	2, 278, 900	2, 230, 500	2, 282, 900
Federated Malay States	292, 400	299, 200	221, 300	386, 400	505, 000	611, 800
India, British	8, 140, 700	7, 937, 400	7, 943, 500	7, 773, 800	7, 521, 800	6, 805, 800
Indo-China	7, 200	6, 600	6, 600	5, 300	10, 600	10, 600
Japan	6, 557, 800	6, 364, 100	6, 383, 900	6, 905, 700	7, 360, 200	7, 360, 200
Philippine Islands	1, 945, 900	1, 886, 100	1, 639, 600	2, 204, 500	3, 320, 400	3, 704, 500
Sarawak	14, 700	5, 000	5, 000	4, 100	29, 000	35, 700
Taiwan	186, 800	186, 800	303, 700	186, 300	311, 800	311, 800
Turkey	19, 300	19, 900	19, 900	18, 600	18, 600	18, 600
Africa	218, 759, 600	226, 580, 500	228, 870, 700	233, 033, 400	235, 346, 900	242, 912, 100
Australasia	13, 961, 800	13, 481, 600	14, 251, 000	14, 212, 500	12, 090, 100	12, 856, 600
	393, 301, 100	399, 981, 700	401, 678, 400	408, 385, 000	403, 103, 900	416, 751, 500

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[1] Philippine Islands excluded.

SILVER

The world production of silver in 1930 decreased 12,830,900 ounces from the 1929 output. The largest decreases were: United States (excluding the Philippine Islands), 10,606,000 ounces; Mexico, 3,460,500 ounces; and Peru, 5,994,800 ounces. A few countries reported an increased output of silver. The largest increases were: Canada, 3,292,600 ounces; Chile, 403,900 ounces; Poland, 198,100 ounces;

Bolivia, 2,274,900 ounces; and Central America, 900,000 ounces. The United States and Canada produced 31 per cent of the total (32 per cent in 1929); Mexico, Central America, and South America produced about 54 per cent; and all other countries—mainly Australia, Burma, Japan, and Spain—produced less than 16 per cent. More than one-half of the world output of silver is produced or refined in the United States; but a large part of it is consumed in China, India, and Europe. Only about one-half of the domestic mine production of silver of the United States is consumed by domestic arts and industries. The remainder, and all the silver from foreign ores and bullion, must find a foreign market.

World production of silver, 1925–1930, in fine ounces

Country	1925	1926	1927	1928	1929	1930
North America:						
Canada	20,229,000	22,371,900	22,736,700	21,936,400	23,143,300	26,435,900
Central America	2,700,900	3,499,100	3,154,000	2,558,500	3,000,000	3,900,000
Mexico	92,885,500	98,291,200	104,573,900	108,537,300	108,871,400	105,410,900
United States [1]	66,106,900	62,673,000	60,394,200	58,426,000	61,233,300	50,627,200
South America:						
Argentina	18,000	15,000	15,000	15,000	15,000	15,000
Bolivia	4,346,500	5,834,000	5,402,800	5,638,800	4,816,200	7,091,100
Brazil	1,800	20,700	15,600	25,600	21,000	20,000
Chile	3,261,700	2,876,900	2,900,000	1,436,700	328,500	732,400
Colombia	2,900	126,000	131,400	68,200	60,000	60,000
Ecuador	70,000	80,000	87,600	79,800	96,500	106,100
Guiana	8,500	8,000	8,000	7,500	7,500	7,500
Peru	19,917,400	21,499,800	18,295,400	21,607,700	21,495,200	15,500,400
Venezuela	3,200	3,200	3,200	4,000	4,000	4,200
Europe:						
Austria	23,900	14,100	9,700	18,900	10,600	10,200
Czechoslovakia	707,300	765,500	750,000	767,700	723,000	890,600
France	352,000	261,800	308,600	360,100	360,100	360,100
Germany	4,780,400	5,358,900	5,293,400	5,220,800	5,512,800	5,485,400
Great Britain	32,400	41,300	46,700	32,800	36,000	41,000
Greece	254,300	254,300	241,100	241,100	241,100	241,100
Italy	320,800	519,400	537,100	514,400	518,700	571,700
Norway	504,700	308,600	315,100	398,700	282,900	337,800
Poland	212,200	271,700	250,000	235,100	360,600	558,700
Rumania	76,600	93,700	140,700	100,000	90,700	90,700
Russia	250,000	250,000	321,500	380,000	300,000	300,000
Spain	3,303,900	3,000,700	3,056,600	2,526,500	2,659,200	2,659,200
Sweden	----------	80,400	80,400	75,000	75,000	75,000
Yugoslavia	26,100	45,000	53,800	62,700	80,000	100,300
Asia:						
Burma	4,831,500	5,100,000	6,000,000	7,400,000	7,273,300	7,047,000
China	110,000	135,000	100,000	100,000	50,000	50,000
Chosen	70,300	51,900	51,400	56,100	60,100	68,800
East Indies, Netherland	2,385,000	2,363,800	2,285,800	2,032,000	1,967,900	2,094,200
India, British	23,400	25,000	24,800	25,800	25,000	25,000
Indo-China	----------	----------	10,200	53,200	3,200	3,200
Japan	4,835,500	4,776,100	4,531,500	5,144,900	5,674,700	5,674,700
Philippine Islands	68,500	44,000	28,400	36,400	101,500	110,300
Taiwan	13,200	14,300	18,100	11,700	13,000	13,000
Turkey	219,900	225,000	225,100	220,000	220,000	220,000
Africa:						
Algeria	96,500	169,100	118,100	117,400	167,000	167,000
Bechuanaland	500	400	400	100	200	400
Belgian Congo	----------	----------	10,600	10,600	12,000	13,000
British West Africa (Gold Coast, Ashanti, Nigeria)	----------	----------	----------	100	----------	200
East Africa, Portuguese	1,300	1,100	700	300	100	200
Rhodesia	158,000	117,800	131,600	103,900	100,500	73,300
Tanganyika	1,000	800	900	1,600	1,000	1,300
Transvaal, Cape Colony, Natal	1,161,500	981,300	1,011,700	1,031,400	1,031,800	1,050,000
Australasia	10,841,000	11,225,400	10,309,300	10,304,400	9,926,100	9,895,000
	245,214,000	253,795,200	253,981,100	257,925,200	260,970,000	248,139,100

[1] Philippine Islands excluded.

MINE REPORT

METHOD OF COLLECTING STATISTICS

The first table in this report presents the final official figures of the production of gold and silver in the United States in 1930, as agreed upon by the Bureau of the Mint and the Bureau of Mines. With the comparatively unimportant exceptions of domestic gold and silver contained in ore and matte exported for reduction during the year, these figures record the production of gold and silver bullion from domestic ore in marketable form as metals, either refined or unrefined.

To trace this total gold and silver produced back to its source by States, counties, and mining districts, the Bureau of Mines makes a systematic investigation of the "mine production" of ores containing gold and silver and of the output of the placer mines, the output being classified by methods of production and by kinds of ore, as well as by mining districts. The resulting figures form the basis of the mine reports.

Of the two plans for ascertaining the gold and silver production, one is a measure of the metallurgic industry and the other a measure of the mining industry; one reports the metal actually recovered in marketable form and the other the mine output and its recoverable content. The two methods will not produce exactly corresponding results, but the figures for a period of years sufficiently long to compensate for overlap or lag should agree within allowable limits of error.

Gold and silver produced in the United States, 1905–1930, according to mint and mine returns

Year	Mint		Mine	
	Gold	Silver	Gold	Silver
		Fine ounces		*Fine ounces*
1905–1920	$1, 394, 794, 100	997, 827, 596	$1, 382, 689, 196	998, 351, 250
1921	50, 067, 300	53, 052, 441	49, 788, 750	46, 359, 147
1922	48, 849, 100	56, 240, 048	48, 932, 109	61, 235, 983
1923	51, 734, 000	73, 335, 170	51, 400, 382	70, 393, 639
1924	52, 277, 000	65, 407, 186	52, 180, 812	64, 113, 882
1925	49, 860, 200	66, 155, 424	49, 645, 444	66, 776, 275
1926	48, 269, 600	62, 718, 746	48, 075, 596	62, 533, 373
1927	45, 418, 600	60, 434, 441	45, 242, 438	59, 656, 876
1928	46, 165, 400	58, 462, 507	46, 308, 487	57, 909, 870
1929	45, 651, 400	61, 327, 868	45, 883, 477	60, 961, 491
1930	47, 247, 600	50, 748, 127	47, 916, 142	47, 835, 181
	1, 880, 334, 300	1, 605, 709, 554	1, 868, 062, 833	1, 596, 126, 967

These figures show, according to the reports of the mint, a total excess of gold for the 26 years of $12,271,467 (a difference of 0.66 per cent) and a total excess of silver of 9,582,587 ounces (a difference of 0.60 per cent). The small differences are fully accounted for in the detailed discussions of the subject in previous reports of this series.

UNITS OF MEASUREMENT

In the measurement of ores and concentrates the short ton of 2,000 pounds is used throughout. The price of gold is fixed by law at $20.67+ per fine ounce. The annual average prices for silver from 1921 to 1930 are given on page 819.

MINES PRODUCING

LEADING GOLD PRODUCERS

About $30,400,000 in gold (69 per cent of the mine output of the United States, Philippine Islands excluded) in 1930 represented the yield of 25 companies, none of which produced less than $345,000. As in former years, the Homestake mine in South Dakota was much the largest producer. The Alaska Juneau ranked second in total output of gold; and the Fairbanks Exploration Co. of Alaska, which made the largest output from gold dredging, ranked fourth. Nine of the large producers were in California, 4 each in Arizona and Utah, 3 in Alaska, 2 each in Nevada and Colorado, and 1 in South Dakota. Twelve of these companies produced gold from dry and siliceous ores; 5 from gravel by dredging; 3 from copper ore; 1 from dry and siliceous ore, lead ore, and lead-zinc ore; 1 from copper ore and lead-zinc ore; 1 from copper ore and siliceous ore; 1 from copper ore and lead ore; and 1 from siliceous ore, lead ore, copper ore, and lead-zinc ore.

Larger producers of gold in the United States in 1930, in order of output

Rank	Operator	State	Mining district	Source of gold
1	Homestake Mining Co	South Dakota	Whitewood	Dry and siliceous ore.
2	Alaska Juneau Gold Mining Co	Alaska	Juneau	Do.
3	Golden Cycle Mining & Reduction Co.[1]	Colorado	Cripple Creek	Do.
4	Fairbanks Exploration Co	Alaska	Fairbanks	Dredging gravel.
5	Empire Star Mines Co. (Ltd.)	California	Grass Valley	Dry and siliceous ore.
6	Natomas Co. of California	do	Natoma	Dredging gravel.
7	Utah Copper Co	Utah	West Mountain	Copper ore and lead-zinc ore.
8	Hammon Engineering Co	California	Marysville	Dredging gravel.
9	United Verde Copper Co	do	Verde	Copper ore and siliceous ore.
10	Hammon Consolidated Gold Fields.	Alaska	Nome	Dredging gravel.
11	Nevada Consolidated Copper Co	Nevada	Robinson	Copper ore.
12	Kennedy Mining & Milling Co	California	Jackson	Dry and siliceous ore.
13	Eureka Standard Mining Co	Utah	Tintic	Do.
14	Argonaut Mining Co	California	Jackson	Do.
15	Tom Reed Gold Mines Co	Arizona	San Francisco	Do.
16	Calumet and Arizona Mining Co	do	Warren	Copper ore.
17	Elkoro Mines Co	Nevada	Jarbidge	Dry and siliceous ore.
18	London Gold Mines Co	Colorado	Mosquito Creek	Do.
19	North Lily Mining Co	Utah	Tintic	Dry and siliceous ore, lead ore, and lead-zinc ore.
20	Original Sixteen to One Mines (Inc.).	California	Alleghany	Dry and siliceous ore.
21	Central Eureka Mining Co	do	Sutter Creek	Do.
22	Capital Dredging Co	do	Folsom	Dredging gravel.
23	United States Smelting, Refining & Mining Co.	Utah	West Mountain	Copper ore, siliceous ore, lead ore, and lead-zinc ore.
24	Phelps Dodge Corporation (Copper Queen).	Arizona	Warren	Copper ore and lead ore.
25	Walker Mining Co	California	Genesee	Copper ore.

[1] Custom mill. Includes ore from Cresson, Portland, United Gold, and other mines.

Besides the output of these large operators, about $13,800,000 in gold came from about 3,700 placer and lode mines, not including those in the Philippine Islands. Some of them had an output of more than $200,000, but the majority produced only small quantities of gold. The Benguet Consolidated Mining Co., Philippine Islands, according to the printed report, produced about $1,773,000 in gold in 1930 and the Balatoc mine in the same district as the Benguet mine about $1,125,900. Only three companies in the United States exceeded the output of the Benguet mine, and as the Balatoc mine is controlled by Benguet stockholders the combined output in 1930 was exceeded only by that of the Homestake and Alaska Juneau properties.

LEADING SILVER PRODUCERS

The output of silver from the 25 leading producing companies in 1930 was about 32,729,000 ounces, or 68.6 per cent of the total (excluding the Philippine Islands). Thirteen of these properties each produced more than 1,000,000 ounces, and none yielded less than 400,000 ounces. The largest output of silver was that of the Anaconda Copper Mining Co., with an output nearly double that of any other operator; the next largest producers were the Tintic Standard Mining Co. of Utah, and the Sunshine Mining Co. and the Bunker Hill & Sullivan Mining & Concentrating Co., both in Idaho. Four mines in Utah, 4 in Idaho, 2 in Arizona, and 1 each in Colorado, Montana, and Nevada produced more than 1,000,000 ounces of silver in 1930. Eight of the 25 large producers of silver were in Utah; 4 each in Idaho and Montana; 3 each in Arizona and Nevada; 2 in Colorado; and 1 in California. Two of these companies recovered silver from dry and siliceous ore; 3 from copper ore; 1 from lead ore; 5 from lead ore and lead-zinc ore; 1 from dry ore, copper ore, and lead-zinc ore; 2 from dry and siliceous ore, lead ore, and lead-zinc ore; 3 from dry and siliceous ore and lead ore; 2 from copper ore, lead ore, and lead-zinc ore; 1 from copper-lead ore; 3 from lead-zinc ore; and 2 from copper ore and lead-zinc ore.

Larger producers of silver in the United States in 1930, in order of output

Rank	Operator	State	Mining district	Source of silver
1	Anaconda Copper Mining Co.	Montana	Summit Valley (Butte).	Copper ore and lead-zinc ore.
2	Tintic Standard Mining Co.	Utah	Tintic	Lead ore and siliceous ore.
3	Sunshine Mining Co.	Idaho	Evolution	Copper-lead ore.
4	Bunker Hill & Sullivan Mining & Concentrating Co.	do	Yreka	Lead ore.
5	Silver King Coalition Mines Co.	Utah	Uintah	Lead ore and lead-zinc ore.
6	United States Smelting, Refining & Mining Co.	do	West Mountain	Lead ore, lead-zinc ore, and copper ore.
7	Empire Zinc Co.	Colorado	Battle Mountain	Dry ore, copper ore, and lead-zinc ore.
8	Hecla Mining Co.	Idaho	Lelande	Lead ore and lead-zinc ore.
9	United Verde Copper Co.	Arizona	Verde	Copper ore.
10	Tonopah Extension Mining Co.	Nevada	Tonopah	Dry and siliceous ore.
11	Park Utah Consolidated Mines Co.	Utah	Blue Ledge and Snake Creek.	Dry and siliceous ore, lead ore, and lead-zinc ore.
12	Federal Mining & Smelting Co.	Idaho	Hunter and Warm Springs.	Lead ore and lead-zinc ore.
13	Calumet and Arizona Mining Co.	Arizona	Warren	Copper ore.
14	Magma Copper Co.	do	Pioneer	Do.
15	Utah Copper Co.	Utah	West Mountain	Copper ore, lead-zinc ore, and lead ore.
16	Sunnyside Mining & Milling Co.	Colorado	Eureka	Lead-zinc ore.
17	St. Joseph Lead Co.	Montana	Barker	Do.
18	Anaconda Copper Mining Co.	do	Hog Heaven	Siliceous ore and lead ore.
19	Treadwell Yukon Co. (Ltd.)	Nevada	Tybo	Lead and lead-zinc ore.
20	Plutus Mining Co.	Utah	Tintic	Dry and siliceous ore and lead ore.
21	Combined Metals Reduction Co.	Nevada	Pioche	Lead-zinc ore.
22	Chief Consolidated Mining Co.	Utah	Tintic	Lead ore, siliceous ore, and lead-zinc ore.
23	Butte & Superior Mining Co.	Montana	Summit Valley (Butte).	Copper ore and lead-zinc ore.
24	Wortley Consolidated Mines (Inc.).	California	Randsburg	Dry and siliceous ore.
25	North Lily Mining Co.	Utah	Tintic	Lead ore and lead-zinc ore.

NUMBER OF MINES

The following table indicates the number of mines that produced gold and silver in 1930. The placers are those in which the gold and the silver that is in natural alloy with the gold and, in a few placers, with platinum are recovered from gravel and sand, whether by hand washing, sluicing, hydraulicking, drifting (in frozen ground or ancient buried river channels), or dredging. The lode mines are those producing gold and silver (from ore as distinguished from gravel) mainly from underground workings, including those whose ore is valuable chiefly for copper, lead, or zinc, but which contribute precious metals as by-products. In addition to producing mines here enumerated, many properties were being prospected and developed, and many other mining claims were being held by assessment work only.

The enumeration of placer mines is less satisfactory than that of lode mines, because some of the operations are only temporary and individually small and because much of the production is made by transitory miners not regularly working placer ground. The unit so far as possible is, as for lode mines, not the operator, but the mining claim or group of claims.

Number of mines in the United States producing gold and silver in 1930, by States [1]

State	Placer	Lode	Total
Alabama	1		1
Alaska [2]	500	24	524
Arizona	41	301	342
California	892	481	1,373
Colorado	21	313	334
Georgia	1	1	2
Idaho	61	131	192
Illinois [3]		2	2
Michigan [3]		2	2
Missouri [3]		2	2
Montana	73	193	266
Nevada	33	247	280
New Mexico	5	88	93
North Carolina	5	3	8
Oregon	143	47	190
Pennsylvania [3]		1	1
South Dakota	8	2	10
Tennessee [3]		2	2
Texas		5	5
Utah		103	103
Vermont		1	1
Washington	14	24	38
Wyoming	1	11	12
	1,799	1,984	3,783

[1] Philippine Islands excluded.
[2] Estimate for placer mines.
[3] Number of mines contributing to production of gold and silver.

Number of mines in the United States producing gold and silver, 1921–1930

Year	Placer	Lode	Total
1921	1,357	1,967	3,324
1922	1,359	2,206	3,565
1923	1,295	2,188	3,483
1924	1,095	2,032	3,127
1925	1,236	2,445	3,681
1926	1,276	2,399	3,675
1927	1,280	2,048	3,328
1928	1,202	1,985	3,187
1929	1,219	2,060	3,279
1930	1,799	1,984	3,783
Average	1,312	2,131	3,443

The total number of mines operated in 1930 was 340 more than the average for the last 10 years. The number of placer properties worked increased 580 compared with 1929 and was 517 less than the number operated in 1906. Increased operations were reported in Alaska, California, Colorado, Montana, Oregon, and Washington.

The number of lode mines operated was 76 less than in 1929 and 147 less than the average for the last 10 years. Good increases in the number of lode mines operated were recorded in California, Colorado, Oregon, and Wyoming. The largest decreases were in States that produced large quantities of base metals, such as Arizona, Idaho, Montana, Nevada, New Mexico, and Utah.

MINE PRODUCTION

SUMMARY

Mine production of gold and silver in the United States in 1930, by States

State	Gold		Silver		Increase or decrease from 1929	
	Fine ounces	Value	Fine ounces	Value	Gold	Silver (fine ounces)
Alabama	21.77	$450	3	$1	+$247	+2
Alaska	410,026.50	8,476,000	408,570	157,299	+715,000	−64,330
Arizona	169,390.38	3,501,610	5,540,732	2,133,182	−680,677	−2,002,551
California	457,199.98	9,451,162	1,622,803	624,779	+924,459	+445,908
Colorado	218,539.82	4,517,619	4,382,852	1,687,398	+100,261	−14,525
Georgia	202.89	4,194	23	9	+1,620	+7
Idaho	21,445.07	443,309	9,420,639	3,626,946	+24,764	+6,236
Illinois			1,797	692		−1,903
Michigan			7,820	3,011		−12,975
Missouri			170,210	65,531		−11,428
Montana	43,489.17	899,001	7,052,889	2,715,362	−232,948	−5,664,088
Nevada	149,064.47	3,081,436	4,219,832	1,624,635	−302,775	−703,694
New Mexico	32,370.42	669,156	1,107,335	426,324	−58,006	−14,211
North Carolina	705.40	14,582	30,054	11,571	+9,528	+8,948
Oregon	14,401.34	297,702	9,000	3,465	−55,621	−21,009
Pennsylvania	629.98	13,023	5,762	2,218	−4,259	−210
Philippine Islands	179,219.69	3,704,800	110,278	42,457	+384,500	+8,798
South Dakota	407,221.14	8,418,008	105,236	40,516	+1,868,409	+20,054
Tennessee	696.02	14,388	83,640	32,201	+2,708	+2,359
Texas	176.47	3,648	389,239	149,857	−22,791	−631,277
Utah	208,455.03	4,309,148	13,129,421	5,054,827	−660,767	−4,462,975
Vermont			4,108	1,582		+824
Washington	4,244.81	87,748	32,816	12,634	+10,850	−14,366
Wyoming	443.02	9,158	122	47	+8,163	+96
	2,317,943.37	47,916,142	47,835,181	18,416,544	+2,032,665	−13,126,310

The preceding table gives the quantity and value of the mine production of gold and silver in 1930 by States, as reported to the Bureau of Mines by the producing mines, and the increase or decrease compared with 1929.

The principal gold-producing States in 1930 were California, Alaska, South Dakota, Colorado, Utah, Arizona, and Nevada (mines in the Philippine Islands produced more gold in 1930 than those in Arizona or Nevada), and these States supplied 94.4 per cent of the total output (Philippine Islands excluded). The only change in the order of output is that Colorado regained fourth place from Utah. The notable increases in output were in Alaska, California, Colorado, Philippine Islands, and South Dakota—all large producers of gold from siliceous ores or placers. The increase in South Dakota and the Philippine Islands was due almost entirely to dry gold ore milled. The output of South Dakota mines increased more than $1,868,000, or more than twice the increase in California. The notable decreases in output in 1930 were in Arizona, Montana, Nevada, New Mexico, and Utah, all of which yielded large quantities of gold from the treatment of base ores. The output of gold from Oregon, which obtains most of its output from dry and siliceous ores and placers, also decreased in 1930. The output of gold from mines in the Philippine Islands has increased more than $1,800,000 in the last two years.

The principal silver-producing States in 1930, Utah, Idaho, Montana, Arizona, Colorado, and Nevada, produced about 92 per cent of the total; the only change in their ranking was that Idaho supplanted Montana and Colorado, Nevada. California mines showed the only large increase in output of silver. There were small increases in Georgia, Idaho, North Carolina, South Dakota, Tennessee, Vermont, and Wyoming; none of these increases exceeded 21,000 ounces. There were large decreases in the yield of silver from mines in Alaska, Arizona, Montana, Nevada, Texas, and Utah. In all these States except Texas the decrease was due to smaller recoveries from base ores. In Texas the decrease was due to the closing of the Presidio mine, a large producer of siliceous silver ore.

No base ores were treated in the Philippine Islands, and the increase in silver production was due to the larger quantity of bullion from lode gold mines. The total output of silver from Arizona, Montana, and Utah in 1930 was about 12,100,000 ounces less than in 1929.

ORE PRODUCTION, CLASSIFICATION, AND AVERAGE VALUE

The best index of lode mining is found in the quantity, metallic content, and value of ore mined, rather than in the number of mines or of operators. In the next table are given the production of ore from mines producing gold and silver and the average extraction value of precious metals per ton.

The classification adopted is necessarily arbitrary in part. The complex nature of western ores especially and the gradations from one well-recognized class to another render essential a fixed terminology. The dry and siliceous ores comprise gold and silver ores proper, as well as fluxing ores carrying considerable quantities of iron and manganese oxides and very small quantities of gold and silver, and precious metal-bearing ores carrying copper, lead, or zinc in quantities too low to classify them as copper, lead, zinc, or mixed ores. The distinction between gold and silver ores is not here made. The total number of silver mines and the total production of true silver ore are both comparatively small. The copper ores include those containing 2.5 per cent or more of copper, or less than this percentage in the great disseminated copper deposits of the West and in the Lake Superior ores. In general, the lead ores are those containing 5 per cent (dry assay) or more of lead, and the zinc ores are those containing 16 per cent or more of zinc, both irrespective of their precious-metal content; but ores of lower grades in lead and especially in zinc are treated profitably in many districts; and, of course, they are then classified as lead or zinc ores, as the case may be. The mixed ores are combinations of those enumerated.

The lead, zinc, and lead-zinc ores in most districts in the Eastern and Central States carry no appreciable quantity of gold or silver, and such ores are excluded from this report. With the increase in the use of flotation and the recovery of zinc concentrates from lead ore in southeastern Missouri there has been an increase in the total quantity of silver recovered in Missouri, as these zinc concentrates contain 18 to 20 ounces of silver a ton. Singularly, the lead concentrates from the lead ore treated in southeastern Missouri contain very little silver, approximately less than 5 per cent of that contained in the zinc concentrates. The proportion of silver derived from the total quantity of crude lead ore milled is very small.

The total quantity of ore sold or treated annually, from which gold or silver was produced, decreased from 68,000,000 tons in 1918 to 21,500,000 tons in 1921. It then increased steadily until 1926, when the total was 65,787,864 tons; in 1927 the total quantity of ore was 64,526,920 tons; in 1928, 69,747,193 tons; in 1929, 75,653,924 tons, much the largest output ever recorded; and in 1930, 53,972,449 tons.

Ore produced in the United States and average extraction of gold and silver per ton in 1930, by States [1]

State	Dry and siliceous ore		Copper ore		Lead ore		Zinc ore		Copper-lead and copper-lead-zinc ores		Lead-zinc ore		Total (short tons)
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	
Alaska	3, 936, 000	$0. 93	531, 000	$0. 20									4, 467, 000
Arizona	53, 753	14. 21	19, 703, 349	. 24	21, 807	$5. 11			1, 309	$11. 71	22, 701	$3. 86	19, 802, 919
California	730, 712	7. 55	857, 786	. 87	6, 652	8. 30							1, 595, 150
Colorado	710, 491	6. 54	63, 915	10. 45	20, 482	5. 59					540, 843	1. 16	1, 335, 731
Georgia	200	19. 80											200
Idaho	33, 259	9. 27	33, 129	. 81	1, 051, 962	1. 65	807	$0. 38	161, 863	6. 27	663, 880	1. 35	1, 944, 900
Michigan [2]			(2)										(2)
Montana	95, 548	6. 49	2, 238, 997	. 99	23, 642	2. 18	159, 288	1. 13	330	10. 82	168, 864	3. 14	2, 686, 669
Nevada	543, 049	5. 30	4, 015, 426	. 28	10, 413	7. 53	158		30, 171	3. 57	157, 961	2. 94	4, 757, 178
New Mexico	28, 933	2. 83	2, 636, 107	. 17	5, 726	1. 72	89, 113				211, 562	2. 65	2, 971, 441
North Carolina	700	4. 01	97, 445	. 23									98, 145
Oregon	7, 918	10. 53	1, 033	2. 63							43	. 91	8, 994
Pennsylvania [3]			1, 001, 324	2. 49									1, 001, 324
South Dakota	1, 365, 156	6. 20											1, 365, 156
Tennessee [4]			789, 495	. 06			(4)				(4)		789, 495
Texas	29, 677	5. 17	734	. 22	736								31, 147
Utah	223, 010	10. 24	9, 696, 962	. 21	237, 240	7. 17			52, 757	1. 92	831, 872	3. 90	11, 041, 841
Vermont			28, 418	. 06									28, 418
Washington	7, 710	10. 69	28, 565	. 44	1, 981	. 48					7, 200	. 05	45, 456
Wyoming	1, 173	7. 72	112	. 09									1, 285
	7, 767, 289	3. 81	41, 723, 797	. 29	1, 380, 641	2. 85	249, 366	. 72	246, 430	5. 04	2, 604, 926	2. 46	53, 972, 449
Percentage	14. 39		77. 30		2. 56		0. 46		0. 46		4. 83		100. 00
1929:													
Total	7, 671, 150	3. 67	62, 140, 833	. 31	1, 592, 043	4. 40	494, 372	1. 76	259, 126	6. 15	3, 496, 400	2. 84	75, 653, 924
Percentage	10. 14		82. 14		2. 11		0. 65		0. 34		4. 62		100. 00

[1] Illinois, Missouri, and Philippine Islands excluded; quantity of crude ore containing gold and silver unknown.

[2] No electrolytic refining of copper reported. Output of silver was 7,820 ounces in lump picked up in mines and sold to mints and refineries.

[3] Ore is pyritiferous magnetite yielding 6,121 tons of copper concentrates; value given is per ton of concentrates.

[4] Zinc ore and lead-zinc ore yielded no gold or silver.

Arizona led in total quantity of ore produced by more than 8,761,000 tons, with over 99 per cent of its output copper ore; Utah ranked second, with 88 per cent copper ore; Nevada was third, with 84 per cent copper ore; Alaska was fourth, with 88 per cent siliceous ore; and New Mexico, Montana, Idaho, California, South Dakota, and Colorado followed in order. Eighty-nine per cent of the ore from New Mexico was copper ore, and most of the remainder was lead-zinc ore. The output from Idaho was mainly lead ore and lead-zinc ore, that from South Dakota was all siliceous ore, and that from Alaska was 88 per cent siliceous ore and the remainder copper ore. The principal ores mined in California were copper ore and siliceous ore. Fifty-three per cent of the ore from Colorado was siliceous ore, and 40 per cent was lead-zinc ore.

The quantity of copper ore sold or treated in 1930 decreased 20,417,036 tons (33 per cent) largely because of decreased production in Alaska, Arizona, California, Montana, Nevada, New Mexico, and Utah, although smaller decreases were also recorded in nearly all the other States. Colorado showed the only substantial increase. The quantity of lead ore (containing gold or silver) decreased 211,402 tons. There were increases in California, Idaho, and Montana; but these were more than offset by decreases in Arizona, Colorado, Nevada, New Mexico, Utah, and Washington. The quantity of zinc ore (containing gold or silver) was only about half of that shipped in 1929, and this zinc ore came almost entirely from mines in Montana and New Mexico. The quantity of lead-zinc ore decreased 891,474 tons, largely as the result of smaller shipments of ore from Utah, Idaho, Montana, Arizona, New Mexico, and Washington. The only increased shipments of lead-zinc ore in 1930 were from mines in Colorado and Nevada. The quantity of copper-lead ore and copper-lead-zinc ore was 12,696 tons less than in 1929; Idaho, Nevada, and Utah produced the bulk of such ore in 1930. The output of dry and siliceous ore increased 96,139 tons, following decreases of 423,593 tons in 1929 and 454,977 tons in 1928. The large increases were in Alaska, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Washington, and Wyoming. There were decreases in Arizona, Montana, South Dakota, Texas, and Utah.

The value of the gold and silver recovered from 46,205,160 tons of base ores in 1930 was $23,897,550 ($14,513,179 less than in 1929), an average of 52 cents a ton, of which about 19 cents, or 37 per cent, represents gold. The average recovery from dry and siliceous ore in 1930 was $3.37 in gold a ton, so that 1 ton of such ore yielded 17.74 times as much gold as was derived from 1 ton of ore of all other classes combined and 20 times as much as was derived from 1 ton of copper ore. Copper ore constituted more than 77 per cent of the total quantity of ores containing gold and silver in 1930. The large decrease in the output of copper ore in 1930 reduced the output of gold from that source by $2,580,970 compared with 1929. There will be another large decrease in the gold derived from base ores in 1931, and it does not seem probable that the gold recovered from such ores will equal that in 1929 in the immediate future.

In 1930 Utah recovered an average of $7.17 a ton in gold and silver from lead ore; and Idaho, which produced 76 per cent of the total output of lead ore (containing gold and silver), showed an average recovery from this source of only $1.65 a ton. Lead ore from Nevada (10,413 tons) yielded $7.53 a ton, that from Colorado (20,482 tons) $5.59 a ton, that from Arizona (21,807 tons) $5.11 a ton, and that from Montana (23,642 tons) $2.18 a ton. In the output of ore considered as yielding gold and silver the proportion of dry and siliceous ore increased from 10.14 to 14.39 per cent, that of lead ore increased from 2.11 to 2.56 per cent, and that of copper ore decreased from 82.14 to 77.30 per cent. The proportion of all other classes of ore combined increased from 5.61 per cent of the total in 1929 to 5.75 per cent in 1930.

The peak of production of dry and siliceous ore from 1906 to 1930 was reached in 1916, although the proportion of such ores to the total was largest in 1906. The extraction value of ore of this class varies greatly, depending largely on the quantity of low-grade ore milled in Alaska and South Dakota; the bulk of such ore comes from these two States. In 1930 Alaska produced 51 per cent and South Dakota 18 per cent of the dry and siliceous ore treated. Most of this output was milled at two properties.

The average recovery of gold and silver from dry and siliceous ore decreased steadily—it went down from $6.98 a ton in 1922 to $3.59 in 1927. In 1928 the recovery increased to $3.86 a ton. The average recovery in 1929 was $3.67 a ton, and in 1930 it increased to $3.81 a ton. The decided decrease in the average extraction value of gold and silver in copper ore—from $1.55 a ton in 1906 to 31 cents in 1928 and 1929 and 29 cents in 1930—was caused by the lower price of silver and the low gold and silver content of copper ore from Arizona, New Mexico, Nevada, and Utah. Silver predominates over gold in nearly all lead ore. Mines in Utah contributed 74 per cent of the gold from lead ore. The recovery of gold and silver from lead ore in 1930 was $2.85 a ton, compared with an average recovery of $4.40 a ton in 1929. Zinc ore constituted less than 1 per cent of the total ore shown in the table on page 830; its extraction value was only $0.72 a ton, almost entirely in silver. Lead-zinc ore yielded an average of only 54 cents a ton in gold, but about 5 ounces of silver a ton were reported. Copper-lead ore and copper-lead-zinc ore treated decreased 12,696 tons in 1930 in quantity and yielded $5.04 in gold and silver a ton. The gold content of these classes of ore is not important, but they contain good values in silver; such ore treated in 1930 averaged about 12.4 ounces of silver to a ton of crude ore. The gold recovered from such ore averaged only about 27 cents a ton.

Ore produced in the United States and average extraction value of gold and silver per ton, 1921–1930 [1]

Year	Dry and siliceous ore		Copper ore		Lead ore	
	Short tons	Average value	Short tons	Average value	Short tons	Average value
1921	8,436,214	$6.65	10,930,888	$0.54	2,053,575	$7.89
1922	8,728,222	6.98	23,356,128	.56	2,123,673	8.24
1923	9,121,719	5.91	41,596,309	.42	2,287,494	7.56
1924	8,979,113	5.21	44,887,379	.39	2,358,602	5.71
1925	8,994,910	4.57	47,186,114	.42	2,271,077	6.20
1926	8,743,386	4.03	51,064,058	.36	2,023,572	5.26
1927	8,549,720	3.59	49,966,438	.32	2,004,729	4.89
1928	8,094,743	3.86	55,870,147	.31	1,686,631	5.09
1929	7,671,150	3.67	62,140,833	.31	1,592,043	4.40
1930	7,767,289	3.81	41,723,797	.29	1,380,641	2.85

[1] Arkansas, Illinois, Missouri, Philippine Islands, and Porto Rico excluded; quantity of crude ore containing gold and silver not known.

Ore produced in the United States and average extraction value of gold and silver per ton, 1921–1930—Continued

Year	Zinc ore		Copper-lead and copper-lead-zinc ores		Lead-zinc ore		Total (short tons)
	Short tons	Average value	Short tons	Average value	Short tons	Average value	
1921	10, 116	$0. 76	14, 248	$31. 76	122, 287	$16. 96	21, 567, 328
1922	471, 172	3. 68	52, 370	13. 76	444, 845	7. 89	35, 176, 410
1923	723, 994	2. 55	162, 181	7. 30	1, 203, 698	3. 39	55, 095, 395
1924	145, 858	. 14	219, 874	3. 83	1, 791, 852	3. 14	58, 382, 678
1925	169, 432	. 79	228, 612	3. 44	2, 703, 471	3. 37	61, 553, 616
1926	214, 366	1. 03	282, 015	3. 38	3, 460, 467	3. 01	65, 787, 864
1927	452, 490	2. 18	418, 601	3. 07	3, 134, 942	2. 99	64, 526, 920
1928	161, 311	. 44	351, 141	4. 09	3, 583, 220	3. 09	69, 747, 193
1929	494, 372	1. 76	259, 126	6. 15	3, 496, 400	2. 84	75, 653, 924
1930	249, 366	. 72	246, 430	5. 04	2, 604, 926	2. 46	53, 972, 449

GOLD, BY SOURCES

As the following table indicates, 79.86 per cent of the domestic output of gold in 1930 was obtained from dry and siliceous ores—normally gold quartz and gold-silver quartzose ores—and from placers, compared with 72 per cent in 1929. The total contribution of gold from the great copper, lead, and zinc mines of the country was only 20.14 per cent.

Mine production of gold in the United States in 1930, by States, in fine ounces[1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
Alabama	21. 77							21. 77
Alaska	233, 989. 88	176, 036. 62						410, 026. 50
Arizona	631. 63	33, 483. 46	132, 086. 77	1, 243. 15		359. 80	1, 585. 57	169, 390. 38
California	181, 655. 05	251, 575. 20	23, 473. 31	496. 42				457, 199. 98
Colorado	6, 687. 51	194, 374. 17	4, 675. 33	2, 222. 68			10, 580. 13	218, 539. 82
Georgia	11. 71	191. 18						202. 89
Idaho	3, 987. 45	14, 242. 78	810. 36	1, 073. 79			1, 330. 69	21, 445. 07
Montana	720. 74	17, 752. 33	21, 715. 70	788. 58	349. 96	7. 80	2, 154. 06	43, 489. 17
Nevada	1, 859. 44	93, 031. 52	50, 083. 92	1, 037. 94		383. 51	2, 668. 14	149. 064. 47
New Mexico	63. 66	1, 877. 88	17, 138. 87	61, 04			13, 228. 97	32, 370. 42
North Carolina	48. 08	134. 87	522. 45					705. 40
Oregon	10, 372. 54	3, 916. 80	112. 00					14, 401. 34
Pennsylvania [2]			629. 98					629. 98
South Dakota	47. 41	407, 173. 73						407, 221. 14
Tennessee			696. 02					696. 02
Texas		176. 47						176. 47
Utah		69, 253. 15	80, 953. 27	19, 660. 23		2, 516. 84	36, 071. 54	208, 455. 03
Washington	190. 90	3, 953. 14	100. 43	. 34				4, 244. 81
Wyoming	6. 48	436. 54						443. 02
	440, 294. 25	1, 267, 609. 84	332, 998. 41	26, 584. 17	349. 96	3, 267. 95	67, 619. 10	2, 138, 723. 68
Value	$9, 101, 690	$26, 203, 821	$6, 883, 688	$549, 544	$7, 234	$67, 554	$1, 397, 811	$44, 211, 342
Percentage	20. 59	59. 27	15. 57	1. 24	0. 02	0. 15	3. 16	100. 00
1929: Total	408, 260. 01	1, 074, 254. 11	457, 852. 82	37, 230. 15	1, 348. 14	3, 940. 14	76, 108. 31	2, 058, 993. 68
Value	$8, 439, 483	$22, 206, 803	$9, 464, 658	$769, 616	$27, 869	$81, 450	$1, 573, 298	$42, 563, 177
Percentage	19. 83	52. 17	22. 24	1. 81	0. 06	0. 19	3. 70	100. 00

[1] Philippine Islands excluded. The Bureau of Science, Manila, P. I., reports that bullion from lode mines of the Philippine Islands yielded 178,821.62 ounces of gold, and placer mines, 398.08 ounces.

[2] From pyritiferous magnetite ore.

Examination of the data on domestic mine production of gold from different sources shows that the recovery from placer mines was 27 per cent of the total output for the period 1906 to 1910, inclusive, and only 22.5 per cent of the total output for the period 1921 to 1925, inclusive. In some later years placer mines have yielded the following percentages of the total output of gold: 1927, 21.4 per cent; 1928, 19.4 per cent; 1929, 19.83 per cent; and 1930, 20.59 per cent. The recovery of gold from dry and siliceous ore was 67 per cent of the total output for the period 1911 to 1915, inclusive; it was only 55.2 per cent of the total in 1927, 55.7 per cent in 1928, 52.17 per cent in 1929, and 59.27 per cent in 1930. The domestic gold recovered from copper ore has increased from about 5.8 per cent of the total for the period 1906 to 1908, inclusive, to nearly 17.5 per cent in 1927, 19.3 per cent in 1928, 22.24 per cent in 1929, and 15.57 per cent in 1930. The recovery of gold from all other base ores was about 2.3 per cent of the total for the period 1906 to 1910, inclusive, nearly 6 per cent in 1927, 5.6 per cent in 1928, 5.76 per cent in 1929, and 4.57 per cent in 1930. The gold from copper ore and other base ores may increase in future years, but this increase must be proportionately small. Gold recovered from dredging gravels is declining in California but increasing in Alaska, so that on the whole little increase can be expected from this source. There have been increased operations at some large gold mines, and the lower cost of labor and supplies has encouraged the reopening of many small mines and more extended prospecting. The latter will increase the output in many States and will prevent any notable decline in the output of the United States, notwithstanding the much lessened activity at base-metal mines.

Gold produced in the United States, by sources, as reported by mines, 1921–1930, in fine ounces [1]

Year	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
1921	677, 435	1, 548, 251	52, 765	61, 924	76	159	4, 400	2, 345, 010
1922	537, 910	1, 560, 789	130, 928	35, 415	2, 807	2, 467	22, 935	2, 293, 251
1923	551, 929	1, 510, 098	271, 690	38, 109	3, 321	3, 801	25, 965	2, 404, 913
1924	450, 720	1, 602, 469	310, 413	39, 947	227	1, 995	38, 560	2, 444, 331
1925	436, 251	1, 414, 446	348, 025	50, 378	375	5, 515	52, 384	2, 307, 374
1926	457, 717	1, 295, 570	365, 223	45, 724	1, 194	3, 335	63, 763	2, 232, 526
1927	451, 215	1, 162, 404	367, 639	41, 504	1, 563	2, 631	80, 076	2, 107, 032
1928	416, 832	1, 195, 804	414, 771	35, 960	130	6, 973	77, 594	2, 148, 064
1929	408, 260	1, 074, 254	457, 853	37, 230	1, 348	3, 940	76, 108	2, 058, 993
1930	440, 294	1, 267, 610	332, 999	26, 584	350	3, 268	67, 619	2, 138, 724

[1] Philippine Islands and Porto Rico excluded.

PLACERS

General features.—The output of gold from placer mines in the United States (other than 398 ounces, the estimated placer yield in the Philippine Islands) in 1930 was 440,294 ounces, compared with 408,260 ounces in 1929. As Alaska produced 233,990 ounces, California 181,655 ounces, and Oregon 10,373 ounces, less than 14,277 ounces came from placers in all other States. The States showing the largest increases were Alaska (34,830 ounces), Arizona (358 ounces), Colorado (4,470 ounces), and Montana (124 ounces). The States showing the largest decreases were California (5,586 ounces), Georgia (82 ounces), Idaho (142 ounces), Nevada (258 ounces), Oregon (1,575 ounces), and Washington (105 ounces). The increase or decrease in placer gold in other States was unimportant. The placer gold is derived chiefly from dredging (which yielded 85 per cent of the total in 1930), from placers operated by hydraulicking, and from those worked by drift mining or by sluicing. The last two methods are relatively unimportant, except in Alaska, California, and Oregon. There is also a small annual output of gold from dry placer mining in Arizona, California, and New Mexico, and of gold and platinum from ocean-beach mining in California and Oregon, but these sources are insignificant as producers of gold.

Dredging.—The value of gold recovered by dredges in the United States, from the commercial inception of the industry in 1896 to the end of 1930, has amounted, according to the most authentic data available, to $240,096,731, divided as follows: California, $167,005,744; Alaska, $42,920,074; Montana, $9,592,435; Colorado, $8,271,245; Idaho, $6,155,602; Oregon, $5,516,681; and other States, $634,950. The output of gold from dredges in 1930 was $7,738,222, compared with $6,831,301 in 1929. The number of dredges operated in 1930 was 60, compared with 63 in 1929. Of the total for 1930 California produced $3,451,801 from 24 dredges, Alaska $3,912,600 from 27 dredges, Idaho $68,527 from 3 dredges, Oregon $174,470 from 5 dredges, and Colorado $130,824 from 1 dredge. No dredges were operated in Montana, Nevada, or Washington in 1930, and 1 dredge in the Philippine Islands operated for a short period in 1930 yielded $8,227. Dredges in Alaska produced $980,600 more gold in 1930 than in 1929, that in Colorado $92,327 more, and those in Idaho $8,384 more. In 1930 the output of gold from dredges in California decreased $137,458 and that from dredges in Oregon decreased $30,994, compared with the 1929 figures. Only twice in the last decade, in 1921 and 1923, was the output of gold from dredges more than in 1930. The increase in 1930 was due mainly to the large increase in gold from dredges in Alaska.

Gold dredges operated in the United States in 1930 [1]

ALASKA

Name	Address	District	Number of dredges
Chatham Gold Dredging Co	Fairbanks	Fairbanks	1
Fairbanks Exploration Co	do	do	5
Fairbanks Gold Dredging Co. (Ltd.)	do	do	2
Tanana Valley Gold Dredging Co. (Ltd.)	do	do	1
New York Alaska Gold Dredging Corporation	Candle	Fairhaven	1
Northern Star Dredging Co	Council	Council	1
Ophir Gold Dredging Co	Nome	do	1
North American Dredge Co	Flat	Iditarod	1
J. E. Riley Investment Co	Iditarod	do	1
Felder-Gale & Higgins	Takotna	Innoko	1
Flume Dredge Co	do	do	1
Gibbs & Eison	do	do	1
Dime Creek Dredging Co	Haycock	Koyuk	1
Dry Creek Dredging Co.	Nome	Nome	1
Hammon Consolidated Gold Fields	do	do	3
Hastings Creek Dredging Co	do	do	1
Osborn Mining Co	do	do	1
Goldsmith Dredging Co	do	Solomon	1
Spruce Creek Dredging Co	Solomon	do	1
Nome Creek Dredging Co	Fairbanks	Tolovana	1
CALIFORNIA			
Lancha Plana Gold Dredging Co	Camanche	Lancha Plana	1
Shasta Butte Gold Dredging Co	Oroville	Oroville	1
Milton Mining Co	Turlock	Jenny Lind	1
Pioneer Gold Dredging Co	San Francisco	Snelling	1
Capital Dredging Co	do	Folsom	3
Natomas Co	Sacramento	Natoma	6
Shasta Butte Gold Dredging Co	Oroville	Horsetown	1
LaGrange Gold Dredging Co	San Francisco	LaGrange	1
Madrona Dredging Co	Lewiston	Junction City	1
Placer Development Co	San Francisco	Lewiston	1
Trinity Dredging Co	Lewiston	do	1
Garden Valley Dredge (C. W. Evans)	Modesto	Camptonville	1
Hammon Engineering Co. (Yuba Consolidated)	San Francisco	Marysville	4
Kumle Dredge	Bangor	Smartsville	1

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[1] A small output of gold was made by 1 dredge in the Philippine Islands which was operated for 6 months in 1930.

Gold dredges operated in the United States in 1930—Continued

COLORADO

Name	Address	District	Number of dredges
Continental Dredging Co	Breckenridge	Breckenridge	1

IDAHO

Name	Address	District	Number of dredges
Idaho Gold Dredging Corporation	Boise	Boise Basin	1
Crooked River Mining Co	Nampa	Banner	1
American Gold Dredging Corporation	Boise	Steele	1

OREGON

Name	Address	District	Number of dredges
Superior Leasing Co	Baker	Malheur	1
Hydraulic Dredging & Construction Co	Sumpter	Sumpter	1
Empire Gold Dredging & Mining Co	Prairie City	Canyon	1
Granite Creek Dredging Co	Granite	Granite	1
Rogue River Gold Co	Rogue River	Gold Hill	1

Gold produced in the United States by dredges, 1921–1930

Year	Dredges	California	Alaska	Other States[1]	Total
1921	72	$7,756,787	$1,582,520	$1,196,261	$10,535,568
1922	71	4,999,215	1,767,753	922,300	7,689,268
1923	66	6,065,735	1,848,596	1,084,716	8,999,047
1924	63	4,305,521	1,563,361	1,044,099	6,912,981
1925	60	4,750,842	1,572,312	507,874	6,831,028
1926	63	4,950,545	2,291,000	281,240	7,522,785
1927	59	5,461,929	1,740,000	313,661	7,515,590
1928	57	4,430,913	2,185,000	276,418	6,892,331
1929	63	3,589,259	2,932,000	310,042	6,831,301
1930	60	3,451,801	3,912,600	373,821	7,738,222

[1] Colorado, Idaho, Montana, Nevada, Oregon, and Washington.

Further information on this subject may be found in previous issues of Mineral Resources, in reports of the Director of the Mint, and in reports of geological surveys or mining officials of the various States.

DRY AND SILICEOUS ORES

The siliceous ore comprises free-milling (amalgamating) ore, as in Alaska, California, and Oregon; both amalgamating and concentrating ore, as in many States; concentrating ore, as in parts of Colorado and Arizona; all-sliming and cyaniding ore, as in Nevada; and smelting ore. Tailings both from old dumps and from current millings are largely reworked by concentration and subsequent cyanidation or smelting. The material smelted consists mainly of concentrates and siliceous and pyritic ores, which are also valuable as fluxes. Figures of relative output by methods and States are given on page 843.

As most of the gold produced in the United States is derived from placer gravel and dry and siliceous ores, including true gold, gold-silver, and silver ores, the following table for certain States has special interest.

Gold produced in six Western States, 1926–1930

State and year	Total (lode and placer)			Gold ore				Gold-silver ore		Silver ore		Placer	
	Mines producing	Ore mined (short tons)	Gold (fine ounces)	Mines producing	Short tons	Gold (fine cunces)		Short tons	Gold (fine ounces)	Short tons	Gold (fine ounces)	Mines producing	Gold (fine ounces)
						Total	Average						
Arizona:													
1926	383	22, 382, 685	234, 010. 97	74	111, 083	47, 586. 24	0. 43	9, 440	1, 713. 32	19, 426	1, 385. 74	21	338. 96
1927	308	21, 991, 874	200, 494. 59	77	122, 153	27, 032. 05	. 22	11, 074	2, 090. 88	18, 474	1, 295. 19	15	302. 68
1928	320	22, 828, 766	191, 927. 23	74	52, 089	17, 844. 40	. 34	53, 264	1, 366. 63	41, 472	3, 372. 46	22	309. 60
1929	412	25, 860, 772	202, 318. 14	69	68, 891	14, 428. 87	. 21	9, 377	1, 477. 56	11, 636	175. 56	22	273. 43
1930	342	19, 802, 919	169, 390. 38	86	48, 538	33, 047. 09	. 68	1, 822	347. 53	3, 393	88. 84	41	631. 63
Idaho:													
1926	246	1, 934, 143	13, 669. 27	41	5, 124	2, 811. 27	. 55	44	107. 85	694	76. 05	69	8, 360. 45
1927	218	2, 018, 325	15, 315. 67	41	4, 389	4, 622. 17	1. 05	37	141. 57	842	59. 54	70	7, 520. 33
1928	207	2, 054, 329	20, 980. 38	46	10, 304	11, 149. 07	1. 08	201	37. 37	66	9. 40	56	8, 191. 63
1929	198	2, 174, 125	20, 247. 11	37	26, 459	12, 709. 23	. 48	7	81. 24	117	39. 59	51	4, 129. 92
1930	192	1, 944, 900	21, 445. 07	47	32, 420	14, 179. 62	. 44	2	2. 11	837	61. 05	61	3, 987. 45
Montana:													
1926	393	4, 470, 055	60, 504. 11	101	80, 847	21, 583. 35	. 27	1, 415	482. 70	11, 309	1, 744. 02	58	1, 104. 30
1927	307	4, 222, 607	53, 541. 25	79	50, 764	16, 467. 40	. 32	170	138. 94	61, 042	1, 782. 96	60	1, 079. 97
1928	279	4, 344, 279	58, 196. 09	81	71, 102	16, 810. 30	. 24	207	146. 14	41, 022	1, 535. 66	43	865. 14
1929	252	4, 723, 445	54, 758. 03	69	57, 676	14, 549. 72	. 25	847	540. 78	43, 745	1, 883. 50	40	596. 66
1930	266	2, 686, 669	43, 489. 17	106	78, 376	17, 396. 01	. 22	371	90. 00	16, 801	266. 32	73	720. 74
Nevada:													
1926	405	5, 884, 568	175, 381. 68	139	141, 967	51, 699. 25	. 36	433, 749	50, 090. 77	230, 802	24, 825. 08	28	2, 866. 17
1927	409	5, 531, 152	150, 346. 16	158	294, 308	66, 615. 25	. 23	5, 269	1, 268. 99	216, 248	26, 823. 26	30	1, 809. 22
1928	359	7, 057, 433	175, 157. 79	142	419, 043	73, 223. 74	. 17	75, 297	2, 911. 02	146, 664	24, 168. 60	29	1, 851. 12
1929	338	7, 355, 500	163, 711. 22	118	384, 381	65, 742. 36	. 17	3, 953	1, 725. 61	149, 330	23, 187. 68	15	2, 117. 00
1930	280	4, 757, 178	149, 064. 47	132	414, 023	72, 690. 07	. 176	1, 523	283. 78	127, 503	20, 057. 67	33	1, 859. 44
Utah:													
1926	166	15, 856, 144	182, 762. 98	7	344	1, 297. 40	3. 77	113, 476	14, 165. 75	187, 393	8, 633. 93	2	16. 16
1927	123	15, 757, 074	193, 908. 82	7	4, 226	3, 390. 88	. 80	83, 004	7, 667. 38	158, 114	11, 651. 73		
1928	124	18, 427, 117	212, 559. 79	8	14, 704	8, 700. 95	. 59	36, 063	7, 848. 56	160, 991	9, 024. 27	3	46. 00
1929	130	19, 831, 975	240, 419. 63	9	25, 564	20, 561. 46	. 80	55, 001	7, 331. 56	174, 627	8, 279. 74	3	46. 25
1930	103	11, 041, 841	208, 455. 03	16	65, 200	56, 292. 01	. 86	99, 458	9, 953. 31	58, 352	3, 007. 83		
Washington:													
1926	58	54, 343	9, 340. 82	9	17, 599	7, 707. 83	. 44					9	1, 354. 50
1927	33	119, 201	19, 513. 51	11	43, 442	19, 342. 06	. 45			8	. 14	3	18. 82
1928	38	64, 554	16, 310. 45	13	33, 898	16, 097. 84	. 47			58	. 76	1	90. 85
1929	33	93, 527	3, 719. 94	5	5, 120	3, 220. 59	. 63			42	4. 26	4	295. 76
1930	38	45, 456	4, 244. 81	12	7, 710	3, 953. 14	. 51					14	190. 90

Nearly all the siliceous ore in three of the largest gold-producing States—Alaska, California, and South Dakota—yields only a small quantity of silver and is classed as gold ore. The siliceous ore from Colorado includes some silver and gold-silver ore.

Siliceous ore treated and gold recovered per ton of ore treated, 1921–1930

Year	Alaska		California		South Dakota		Colorado	
	Ore treated	Recovery per ton	Ore treated	Recovery per ton	Ore treated	Recovery per ton	Ore treated	Recovery per ton
	Short tons	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*
1921	2, 894, 813	0. 064	902, 566	0. 402	1, 725, 669	0. 185	1, 230, 172	0. 250
1922	2, 513, 455	. 058	1, 052, 148	. 414	1, 751, 454	. 180	1, 296, 501	. 221
1923	2, 502, 901	. 045	925, 659	. 347	1, 665, 439	. 186	1, 166, 470	. 243
1924	3, 127, 876	. 042	1, 075, 858	. 364	1, 674, 720	. 177	1, 074, 876	. 344
1925	3, 573, 540	. 042	886, 625	. 413	1, 590, 079	. 182	1, 187, 054	. 271
1926	3, 924, 925	. 036	717, 320	. 433	1, 415, 785	. 197	1, 240, 195	. 259
1927	4, 352, 000	. 033	619, 122	. 428	1, 376, 583	. 234	1, 035, 305	. 227
1928	3, 736, 500	. 045	797, 441	. 339	1, 422, 138	. 223	894, 455	. 266
1929	3, 900, 000	. 045	573, 724	. 357	1, 463, 159	. 217	640, 442	. 302
1930	3, 936, 000	. 045	730, 712	. 344	1, 365, 156	. 298	710, 491	. 274

The quantity of siliceous ore treated in South Dakota in 1930 was about 98,700 tons less than in 1929, but the recovery of gold per ton was $1.69 more; the quantity of siliceous ore from California was 156,988 tons more, and the recovery of gold per ton was about 27 cents less; the quantity of siliceous ore treated in Alaska was 36,000 tons more, and the recovery of gold per ton was about the same; and the quantity of siliceous ore treated in Colorado was 70,049 tons more, and the recovery of gold per ton was about 58 cents less. These four States yielded 87 per cent of the total dry and siliceous ore treated in 1930 and 81 per cent of the total gold from such ores.

COPPER ORE

The gold obtained as a by-product in the treatment of copper ore decreased about $2,581,000 in 1930, following increases of about $890,600 in 1929, $974,300 in 1928, $50,000 in 1927, and $355,500 in 1926. The largest producer of gold from copper ore in 1930 was Arizona, with about 39.7 per cent of the total; Utah, with 24.3 per cent, ranked second; Nevada, with 15 per cent, ranked third; and California, Montana, and New Mexico followed. California and Colorado were the only States that showed any important increase in gold derived from copper ore. The large decreases were in Arizona (47,402 ounces), Idaho (1,561 ounces), Montana (9,315 ounces), Nevada (15,204 ounces), New Mexico (161 ounces), and Utah (56,400 ounces).

LEAD ORE

The production of gold from lead ore decreased $220,072, or about 29 per cent, compared with the output in 1929. California, Idaho, and Montana showed small increases in 1930. The recovery of gold from lead ores in Utah declined about 7,762 ounces; mines in the State yielded 74 per cent of the gold from this source.

ZINC, LEAD-ZINC, AND MIXED ORES

Montana produced all the gold from zinc ore (about 350 ounces). Arizona, Nevada, and Utah produced nearly all the gold from copper-lead ore; Utah mines yielded 77 per cent of the total. The combined output of gold from these two classes of ore was only 3,618 ounces. Colorado, New Mexico, and Utah yielded more than 88 per cent of the gold from lead-zinc ores, and Utah mines reported more than half of the total output, which was 8,489 ounces less in 1930 than in 1929. The output of gold from all these small sources was 3.33 per cent of the total gold in 1930 compared with 3.95 per cent in 1929.

SILVER, BY SOURCES

The mine production of silver in 1930 from the chief sources—copper ore, lead-zinc ore, lead ore, and siliceous ore—was 92.58 per cent of the total, compared with 92.68 per cent in 1929. The combined yield of silver from placer bullion, zinc ore, copper-lead ore, and copper-lead-zinc ore was 7.42 per cent in 1930, compared with 7.32 per cent in 1929. The production of silver in the United States (Philippine Islands excluded) as reported to the Bureau of Mines was 47,724,903 ounces, about 22,630,800 ounces less than that in 1923. The combined output from lead and lead-zinc ores decreased from 27,344,541 ounces in 1929 to 21,820,378 ounces in 1930. The recovery from siliceous ore fell 2,367,312 ounces and was 19,891,018 ounces less than in the record year 1922. Mines in Nevada, Utah, and Colorado yielded 72 per cent of the silver from this class of ore. The recovery of silver from copper ore decreased from 17,948,845 ounces in 1929 to 13,617,566 ounces in 1930. The total recovery of silver from base bullion was about 10,767,500 ounces less in 1930 than in 1929.

Mine production of silver in the United States in 1930, by States, in fine ounces [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
Alabama	3							3
Alaska	26, 500	102, 080	279, 990					408, 570
Arizona	85	186, 202	4, 968, 973	222, 541		20, 491	142, 440	5, 540, 732
California	12, 626	823, 000	670, 398	116, 779				1, 622, 803
Colorado	1, 657	1, 628, 152	1, 484, 589	178, 054			1, 090, 400	4, 382, 852
Georgia	1	22						23
Idaho	1, 355	35, 737	26, 262	4, 462, 368	800	2, 635, 993	2, 258, 124	9, 420, 639
Illinois [2]				1, 797				1, 797
Michigan [3]			[3] 7, 820					[3] 7, 820
Missouri				170, 210				170, 210
Montana	86	657, 439	4, 583, 827	91, 635	449, 183	8, 860	1, 261, 859	7, 052, 889
Nevada	847	2, 478, 009	270, 512	148, 033		258, 792	1, 063, 639	4, 219, 832
New Mexico	18	111, 801	228, 494	22, 346			744, 676	1, 107, 335
North Carolina	6	48	30, 000					30, 054
Oregon	1, 579	6, 269	1, 050				102	9, 000
Pennsylvania [4]			5, 762					5, 762
South Dakota	5	105, 231						105, 236
Tennessee			83, 640					83, 640
Texas		388, 828	411					389, 239
Utah		2, 215, 920	944, 113	3, 362, 487		127, 468	6, 479, 433	13, 129, 421
Vermont			4, 108					4, 108
Washington	43	1, 726	27, 592	2, 435			1, 020	32, 816
Wyoming		97	25					122
	44, 811	8, 740, 561	13, 617, 566	8, 778, 685	449, 983	3, 051, 604	13, 041, 693	47, 724, 903
Value	$17, 252	$3, 365, 116	$5, 242, 763	$3, 379, 794	$173, 243	$1, 174, 867	$5, 021, 052	$18, 374, 087
Percentage	0. 09	18. 32	28. 53	18. 40	0. 94	6. 39	27. 33	100. 00
1929: Total	45, 125	11, 107, 873	17, 948, 845	11, 699, 491	1, 576, 715	2, 836, 912	15, 645, 050	60, 860, 011
Value	$24, 052	$5, 920, 496	$9, 566, 734	$6, 235, 829	$840, 389	$1, 512, 074	$8, 338, 812	$32, 438, 386
Percentage	0. 07	18. 25	29. 50	19. 22	2. 59	4. 66	25. 71	100. 00

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[1] Philippine Islands excluded. The Bureau of Science, Manila, P. I., reports that bullion from gold lode mines of the Philippine Islands yielded 110,270 ounces of silver and placer bullion 8 ounces.

[2] From fluorspar-lead ores.

[3] No electrolytic refining of copper reported. Output of silver was in lump picked up in mines and sold to mints and refineries.

[4] From pyritiferous magnetite ore.

Silver produced in the United States, by sources, as reported by mines, 1921–1930, in fine ounces [1]

Year	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Copper-lead and copper-lead-zinc ores	Lead-zinc ore	Total
1921	81, 375	24, 117, 251	4, 782, 538	14, 912, 990	6, 163	449, 417	1, 983. 222	46, 332, 956
1922	60, 769	28, 631, 579	10, 376, 123	16, 756, 835	1, 676, 967	669, 809	3, 035, 907	61, 207, 989
1923	57, 752	27, 636, 947	14, 684, 333	20, 139, 928	2, 171, 186	1, 348, 025	4, 317, 503	70, 355, 674
1924	51, 251	20, 388, 065	16, 335, 433	18, 858, 782	24, 431	1, 194, 323	7, 218, 459	64, 070, 744
1925	50, 303	17, 099, 876	18, 051, 937	18, 777, 853	181, 886	970, 370	11, 577, 855	66, 710, 080
1926	49, 890	13, 567, 095	17, 039, 546	15, 528, 454	313, 119	1, 415, 699	14, 573, 416	62, 487, 219
1927	49, 829	11, 775, 384	14, 556, 572	15, 762, 197	1, 685, 764	2, 171, 792	13, 624, 144	59, 625, 682
1928	46, 276	11, 140, 496	14, 733, 852	13, 416, 657	117, 532	2, 207, 200	16, 210, 430	57, 872, 443
1929	45, 125	11, 107, 873	17, 948, 845	11, 699, 491	1, 576, 715	2, 836, 912	15, 645, 050	60, 860, 011
1930	44, 811	8, 740, 561	13, 617, 566	8, 778, 685	449, 983	3, 051, 604	13, 041, 693	47, 724, 903

[1] Philippine Islands and Porto Rico excluded.

PLACERS

The recovery of silver from the refining of placer bullion in 1930 was 44,811 ounces—314 ounces less than that in 1929. Of the total production 87 per cent came from Alaska and California. The bullion from placers in Nevada contained the largest percentage of silver and from placers in California the smallest percentage of silver. The fineness of placer bullion recovered in western mines varies greatly, so that operators of placer mines receive from about $14 to $19 an ounce for crude gold.

DRY AND SILICEOUS ORES

Approximately 28.4 per cent of the mine production of silver from dry and siliceous ore came from Nevada, 25.4 per cent from Utah (mainly from the Tintic district), and 18.6 per cent from Colorado. The only large increases in the quantity of silver from siliceous ore were in Alaska, California, Idaho, New Mexico, and South Dakota; the large decreases were in Arizona, Colorado, Montana, Nevada, Oregon, Texas, Utah, and Washington.

Much of the silver from gold-silver siliceous ore is obtained with the gold by amalgamation and cyanidation in the mills. Very little of the gold and silver ores is treated by flotation, which is used so extensively on base ores. Flotation in combination with amalgamation and cyanidation may be used as a preliminary treatment of the ore to remove objectionable mineral constituents. This procedure will decrease cyaniding costs and make possible a higher recovery of gold and silver. The remainder of the silver is recovered by smelting and refining base bullion and by smelting some of the richer ore.

COPPER ORE

Nearly all the silver produced from copper ore is obtained in the electrolytic refining of blister copper. The copper ore is mainly sulphide (except the Lake ore of Michigan, which consists of native metal in amygdaloid and conglomerate matrix), and a greater quantity contains chalcocite than chalcopyrite or cupriferous pyrite. The silver tenor of much of the copper ore, especially that of the Santa Rita district, New Mexico, of Bingham, Utah, and of Ely, Nev., is notably low, but other regions yield copper ore that contains considerable quantities of silver. The yield of silver from copper ore in 1930 was about 4,331,300 ounces less than in 1929, a decrease of about one-fourth. In output of silver from copper ore, Arizona, with a yield of 4,968,973 ounces in 1930 (a decrease of 1,630,013 ounces), ranked first, displacing Montana, which produced 7,289,007 ounces from copper ore in 1929 and only 4,583,827 ounces in 1930. Colorado was third with 1,484,589 ounces, compared with 784,933 ounces in 1929. Utah was fourth with 944,113 ounces. These four States yielded 88 per cent of the total silver recovered from copper ore in 1930.

Arizona's production comes mainly from Bisbee and Jerome, Montana's mainly from Butte, Utah's mainly from Bingham, and California's mainly from Plumas County. Of these districts Bisbee well represents disseminated ore bodies, Bingham produces from both lode and disseminated deposits, and the remainder produce silver chiefly from copper ore mined from deep lodes. Some silver is also produced in leaching copper ore.

LEAD ORE

The mine production of silver from argentiferous lead ore was 2,920,806 ounces less in 1930 than in 1929. The only increase in the year 1930 was in California. The large decreases were in Arizona (27,034 ounces), Colorado (155,315 ounces), Idaho (244,140 ounces), Montana (71,665 ounces), Nevada (523,445 ounces), New Mexico (21,649 ounces), and Utah (1,918,756 ounces). Idaho and Utah mines yielded 89 per cent of the silver from lead ore in 1930.

Most of the output is obtained from the desilverization of lead bullion from the smelting of western concentrates. The largest producers of silver-lead ore are the mines in the Park City and Tintic districts in Utah and in the Coeur d'Alene region in Idaho; several hundred mines in many other districts contribute varying quantities of silver from silver-lead ore.

LEAD-ZINC ORE

The output of silver from lead-zinc ore decreased from 15,645,050 ounces in 1929 to 13,041,693 ounces in 1930. The largest producer of silver from lead-zinc ore was Utah, with 6,479,433 ounces in 1930, compared with 7,912,883 ounces in 1929. Other large contributors were Idaho, with 2,258,124 ounces; Montana, with 1,261,859 ounces; Colorado, with 1,090,400 ounces; Nevada, with 1,063,639 ounces; and New Mexico, with 744,676 ounces. The output of silver from lead-zinc ores in these States—except Nevada and New Mexico—was less in 1930 than in 1929, due to the decreased activity at mines other than the Combined Metals mines in Nevada and the Pecos mine in New Mexico. The lead-zinc ores in the Eastern and Central States contain no appreciable quantity of silver.

ZINC AND MIXED ORES

None of the zinc ore treated in States east of Colorado yielded any gold or silver, and the mine production of silver from zinc ore was credited almost entirely to Montana mines in 1930. Mines in this State yielded 449,183 ounces of silver from zinc ore in 1930, compared with 1,576,332 ounces in 1929. Silver from copper-lead and copper-lead-zinc ores increased from 2,836,912 ounces in 1929 to 3,051,604 ounces in 1930; 86 per cent of this output was derived from mines in Idaho. The other large producers of silver from such ore in 1930 were mines in Nevada and Utah. The silver content of the copper-lead and copper-lead-zinc ores treated averaged 10.9 ounces a ton in 1929 and 12.4 ounces a ton in 1930.

GOLD AND SILVER, BY METHODS OF TREATMENT

The following table gives the production of gold and silver from ore, old tailings, etc., treated in 1929 and 1930:

Gold and silver produced in the United States from ore, old tailings, etc., in 1930, by States and by methods of recovery [1]

State	Total quantity of crude ore, old tailings, etc., treated (short tons)	Ore, old tailings, etc., to gold and silver mills				Ore and old tailings to concentrating mills (short tons)	Concentrates from all sources			Crude ore to smelters			Ore leached, old tailings and slag smelted, etc.		
		Ore (short tons)	Old tailings, etc. (short tons)	Gold (fine ounces)	Silver (fine ounces)		Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Alaska	4,467,000	3,935,969	----------	[2] 132,839	[2] 22,418	521,604	45,517	42,995	269,990	9,427	203	89,662	----------	----------	----------
Arizona	19,802,919	24,506	15,612	29,231	26,339	14,556,169	839,312	36,423	1,572,253	2,062,840	102,765	3,927,374	[3] 3,226	339	14,681
California	1,595,150	[4] 654,164	13,869	[5] 193,193	[5] 50,159	846,118	62,281	73,052	964,237	28,804	4,184	396,441	[6] 52,195	5,116	199,340
Colorado	1,335,731	470,634	(7)	146,796	204,268	739,003	138,734	40,857	2,017,247	126,094	24,200	2,159,680	----------	----------	----------
Idaho	1,944,900	31,915	128	12,618	3,797	1,886,882	300,686	4,061	8,802,773	25,975	779	612,714	----------	----------	----------
Montana	2,686,669	4,931	553	1,335	1,707	2,492,121	486,715	37,575	5,590,350	77,674	3,622	1,410,149	111,390	236	50,597
Nevada	4,757,178	242,365	278,230	83,548	2,240,518	4,014,989	237,008	52,258	1,458,320	221,593	11,397	520,145	1	2	2
New Mexico	2,971,441	100	----------	35	242	2,830,965	189,367	17,673	871,402	140,376	14,598	235,673	----------	----------	----------
Oregon	8,994	2,969	3,880	3,039	812	1,014	146	566	4,545	1,131	424	2,064	----------	----------	----------
South Dakota	1,365,156	1,365,156	(8)	407,174	105,231	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Texas	31,147	24,985	----------	132	215,556	5,352	855	44	173,140	810	----------	543	----------	----------	----------
Utah	11,041,841	----------	----------	----------	----------	10,536,145	582,390	110,650	8,193,168	451,517	94,249	4,671,750	54,179	3,556	264,503
Washington	45,456	7,103	----------	3,460	173	36,886	3,020	92	11,983	1,454	491	20,580	13	11	37
Wyoming	1,285	1,162	----------	[9] 395	[9] 96	----------	13	(9)	(9)	123	42	26	----------	----------	----------
Eastern States	[10] 1,917,582	900	----------	326	70	[11] 1,521,880	[11] 58,076	1,070	61,240	[11] 394,802	778	62,270	----------	----------	----------
	53,972,449	6,766.859	312,272	1,014,121	2,871,386	39,989,128	2,944,120	417,316	29,990,648	3,542,620	257,732	14,109,071	[3] 221,004	9,260	529,160
Total, 1929	75,625,830	6,594,869	312,271	894,488	3,372,639	59,090,882	4,021,388	473,055	38,870,742	4,993,630	278,430	17,965,671	4,634,178	4,761	399,701

[1] Exclusive of gold and silver, as follows: From copper ore in Michigan, from lead ore in Missouri, from fluorspar ore in Illinois, and from siliceous ore in Philippine Islands.

[2] Exclusive of bullion from 2,575 tons of concentrates amalgamated, which is included under "Concentrates from all sources."

[3] Exclusive of 3,140,566 tons of ore leached which contained no gold or silver.

[4] Also 6,861 tons of concentrates from California were cyanided and yielded 33,535 ounces of gold and 10,222 ounces of silver. The figures are included under "Concentrates from all sources."

[5] Includes 10,101 ounces of gold and 1,838 ounces of silver from pocket mining.

[6] Includes 51,157 tons of pyrites roasted for the manufacture of sulphuric acid; residue leached amounted to 33,389 tons.

[7] Sands and slimes (243,488 tons) from ore and concentrates first treated by amalgamation were cyanided.

[8] Sands and slimes (1,348,144 tons) from ore first treated by amalgamation were cyanided.

[9] Gold and silver from 13 tons of concentrates included with that from gold and silver mills.

[10] Includes low-grade pyritiferous magnetite ore from Pennsylvania; excludes ore containing no gold or silver.

[11] Includes only ore or concentrates that yielded gold and silver.

The greatest output of ore, etc., was made in Arizona, Utah, Nevada, New Mexico, and Montana, all notable for large yields of copper ore; in Idaho, a large producer of lead ore and lead-zinc ore; in Alaska and California, large producers of both copper and siliceous ores; in Colorado, a large producer of siliceous and lead-zinc ores; and in South Dakota, a consistent large producer of siliceous ore.

The States showing large increases in ore sent direct to gold and silver mills in 1930 were Alaska, Arizona, California, Colorado, Idaho, and Nevada; those showing important decreases were Montana, South Dakota, and Texas.

Many gold and silver mills employ concentrating apparatus, and the concentrates obtained are combined in the preceding table with those from straight concentrating mills under the heading "Concentrates from all sources." The gold and silver included in this item are recovered partly by amalgamation (particularly in Alaska and California) and cyanidation, although most of the concentrates are smelted.

The figures for the quantity of ore treated by concentration include the large quantities of copper, lead, zinc, and mixed ores whose concentrates are smelted primarily for these metals, the gold and silver being recovered in refining the copper and lead bullion and smelting the zinc residues. The quantity of concentrates produced and the recoverable gold and silver content represent not only the concentrates from these straight concentrating mills but also the comparatively small quantity from gold and silver mills.

There was a large increase in 1930 in gold recovered at gold and silver mills but a substantial decrease in the quantity of silver recovered at such mills. Gold recovered at gold and silver mills increased in Arizona, California, Idaho, Nevada, Oregon, South Dakota, Washington, and Wyoming and decreased in Alaska, Colorado, Montana, and Texas. The silver recovered at mills decreased 501,253 ounces. The States showing the largest decreases were Idaho, Montana, Nevada, and Texas. The only large increases were in Arizona, California, Colorado, and South Dakota.

Of the total quantity (39,989,128 tons) of ore containing gold and silver sent direct to concentrating plants in the United States in 1930 Arizona contributed 14,556,169 tons and Utah 10,536,145 tons—a total of 63 per cent of all ore so treated. Most of the decrease in the quantity of ore concentrated in 1930 was caused by the much smaller quantity of copper ore concentrated in these two States. Of the total gold recovered from concentrates about 67 per cent came from four States, as follows: Utah, 26.5 per cent; California, 17.5 per cent; Nevada, 12.5 per cent; and Alaska, 10.3 per cent. Other large producers of gold from concentrates were Arizona, Colorado, Idaho, Montana, and New Mexico. Of the silver from concentrates 29.4 per cent came from Idaho, 27.3 per cent from Utah, and 18.6 per cent from Montana; large quantities also came from Alaska, Arizona, California, Colorado, Nevada, New Mexico, and Texas. The only States that showed an increase in the quantity of ore directly concentrated in 1930 were Colorado and Texas; in all the other States the decrease was very large.

It is interesting to note the trend toward concentration in recent years. In 1919, 5.6 tons of crude ore were treated at concentrating plants for every ton of crude ore sent directly to smelters. In 1930, 11.3 tons of ore were concentrated for every ton of crude ore shipped to smelters, which indicates that the percentage of crude ore concentrated has practically doubled in the last 11 years.

Figures showing the quantity of gold and silver ores treated by flotation in 1930 are given in another chapter of Mineral Resources.

The figures for the quantity and the recoverable gold and silver content of crude ore shipped from the mines direct to the smelters include, in general, the richer gold, silver, copper, and lead ores from which the gold and silver are eventually recovered by refining the copper or lead bullion that collects the precious metals in the smelting. In 1930 Arizona produced 58 per cent and Utah 13 per cent of the ore directly smelted, and Arizona and Utah produced more than 76 per cent of the gold and 61 per cent of the silver recovered from crude ores smelted. The quantity of crude ore smelted in 1930 was only about 9 per cent of that of the crude ore concentrated. Of the crude ore shipped direct to smelters (3,542,620 tons) in 1930, Arizona contributed 2,062,840 tons, mainly copper ore, yielding 40 per cent of the gold and 28 per cent of the silver recovered from ore directly smelted. Mines in Utah shipped to smelters 451,517 tons of crude ore yielding 36.6 per cent of the gold and 33 per cent of the silver.

Most of the ore leached and old slag, etc., treated came from Arizona, Montana, and Utah mines; other large contributors of such material were mines and old dumps in California. In Arizona 3,140,566 tons of material, from which no gold or silver was recovered, were leached; and in California 52,195 tons of ore, old tailings, etc., yielded 5,116 ounces of gold and 199,340 ounces of silver.

The old materials, mainly tailings and slags, re-treated (with which are included figures for ore and old tailings leached) are partly smelted, often for their fluxing as well as their metal value; considerable quantities of old tailings were concentrated and cyanided in 1930, and the impounding of mill tailings for future treatment, as well as because of legal requirements, has become a general practice. Most of the gold and silver derived from old tailings is included under recoveries by amalgamation and cyanidation at gold and silver mills.

Gold and silver produced at mills in the United States and percentage of gold and silver recovered by smelting and from placers, 1921–1930 [1]

Year	Ore, old tailings, etc., treated (short tons)	Bullion recovered from all sources (fine ounces)				Percentage of gold and silver from all sources							
		Amalgamation		Cyanidation		Amalgamation		Cyanidation		Placers		Smelting [2]	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1921	7,429,125	765,397	207,877	559,352	7,414,275	32.6	0.45	23.9	16.0	28.9	0.18	14.6	83.4
1922	7,442,998	812,396	183,119	541,318	8,803,787	35.4	.3	23.6	14.4	23.5	.1	17.5	85.2
1923	7,657,613	683,274	179,527	607,415	10,044,388	28.4	.3	25.3	14.3	22.9	.1	23.4	85.3
1924	8,023,899	746,777	231,742	563,208	8,921,688	30.6	.4	23.0	13.9	18.4	.1	28.0	85.6
1925	8,022,807	753,313	214,790	476,599	6,360,571	32.6	.3	20.7	9.5	18.9	.1	27.8	90.1
1926	7,948,788	682,345	184,640	455,640	5,173,664	30.6	.3	20.4	8.3	20.5	.1	28.5	91.3
1927	7,741,562	649,044	195,895	377,833	4,177,848	30.8	.3	17.9	7.0	21.4	.1	29.9	92.6
1928	7,242,870	675,222	211,633	374,900	4,256,989	31.4	.4	17.5	7.4	19.4	.1	31.7	92.1
1929	6,907,140	619,776	218,642	324,819	3,229,206	30.1	.4	15.8	5.3	19.8	.1	34.3	94.2
1930	7,079,131	700,318	230,406	380,148	2,728,841	33.2	.5	17.8	5.7	20.6	.1	28.4	93.7

[1] Philippine Islands and Porto Rico excluded.

[2] Both crude ores and concentrates.

About 20.6 per cent of the total gold output in 1930 came from placers; the percentage of the output of silver credited to placers is insignificant. Arizona, California, Colorado, Nevada, and South Dakota yielded the larger part of the gold recovered by cyanidation. The substantial increase in gold recovered by cyanidation was due mainly to increases at mills in Arizona, California, and South Dakota. The quantity of gold recovered by this method in 1930 showed notable decreases in Colorado and Montana.

The gold recovered by amalgamation increased 80,542 ounces in 1930, large increases being in Alaska, California, Colorado, Idaho, Nevada, Oregon, South Dakota, Washington, and Wyoming. There was a decrease in Montana. The recovery of silver by amalgamation is comparatively small, and there was no abnormal change in 1930. The increase in gold recovered by amalgamation naturally resulted in a slight increase in silver from that source.

A large quantity of concentrates from sulphide ores is now smelted, and increased application of the flotation process to base ores has resulted in more concentrates being shipped to smelters (although the quantity so shipped decreased in 1930). Some lead concentrates made in Alaska are first amalgamated to save the gold before the concentrates are shipped to a smelter. The smelters are credited in 1930 with 28.4 per cent of the total output of gold and 93.7 per cent of the silver, compared with 34.3 per cent of the gold and 94.2 per cent of the silver in 1929.

The bulk of the gold continues to come from the gold mills, although the proportion so recovered in 1930 was only 51 per cent of the total, compared with 60 per cent in 1919.

Gold and silver bullion produced at mills in 1930, by States [1]

State	Ore, old tailings, etc., treated (short tons)	Bullion recovered from all sources (fine ounces)				Percentage of gold and silver from all sources in State			
		Amalgamation		Cyanidation		Amalgamation		Cyanidation	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Alaska	3,935,969	[2] 175,313	[2] 101,798	437	97	42.8	24.9	0.1	-----
Arizona	40,118	544	276	28,687	26,063	.3		16.9	0.5
California	668,033	173,515	42,287	43,112	16,256	37.95	2.6	9.4	1.0
Colorado	[3] 470,634	49,798	7,373	96,998	196,895	22.8	.2	44.4	4.5
Idaho	32,043	12,615	3,561	3	236	58.8	.04	-----	-----
Montana	5,484	1,260	619	75	1,088	2.9	.01	.2	.02
Nevada	520,595	9,601	8,037	73,947	2,232,481	6.4	.2	49.6	52.9
New Mexico	100	35	242	-----	-----	.1	.02	-----	-----
Oregon	6,849	3,008	609	31	203	20.9	6.8	.2	2.3
South Dakota	[4] 1,365,156	270,448	65,265	136,726	39,966	66.4	62.0	33.6	38.0
Texas	24,985	-----	-----	132	215,556			75.0	55.4
Washington	7,103	3,460	173	-----	-----	81.5	.5		-----
Wyoming	1,162	395	96	-----	-----	89.2	78.7		-----
Eastern States	900	326	70	-----	-----	14.5	.06		-----
	7,079,131	700,318	230,406	380,148	2,728,841	33.2	.5	17.8	5.7
Value	-----	$14,476,858	$88,706	$7,858,357	$1,050,604	-----	-----	-----	-----

[1] Philippine Islands excluded.

[2] Includes gold and silver from concentrates amalgamated, which amounted to 2,575 tons

[3] Also 243,488 tons of sands and slimes from ore and concentrates amalgamated were treated by cyanidation.

[4] Also 1,348,144 tons of sands and slimes from ore amalgamated were treated by cyanidation.

The great bulk of the ore treated in gold and silver mills was from Alaska, South Dakota, California, Colorado, and Nevada; and in these States the famous mines and mills of the Homestake, Mother Lode, Grass Valley, Treadwell, Cripple Creek, Tonopah, and Goldfield districts are especially noteworthy. Large numbers of smaller mills, however, mark the wide distribution of gold mining in these regions and in many other scattered districts.

The total yield of gold by amalgamation in the United States as reported to the bureau by the mines in 1930 was 700,318 ounces, compared with 619,776 ounces in 1929, 675,222 ounces in 1928, and 1,120,344 ounces in 1911, the first year for which figures are available. The output of gold by cyanidation in 1930 was 380,148 ounces, compared with 324,819 ounces in 1929 and 1,444,077 ounces in 1915, the year of largest recorded output. The quantity of gold recovered by cyanidation has decreased at a much higher rate than the quantity recovered by amalgamation. The output of silver by cyanidation decreased from 3,229,206 ounces in 1929 to 2,728,841 ounces in 1930, the smallest recovery from this source for many years and only about one-fourth of that in 1923. In 1930 Nevada mines yielded about 82 per cent of the total silver recovered by cyanidation and Texas mines 8 per cent, although both States showed a substantial decrease in quantity of silver recovered by this method.

Mines in Alaska, California, Idaho, Montana, Oregon, South Dakota, Washington, and Wyoming recovered more gold by amalgamation than by cyanidation; but cyanidation produced more gold than amalgamation in Arizona, Colorado, Nevada, and Texas. In Alaska, California, Idaho, Oregon, and South Dakota the recovery of silver by amalgamation exceeded that by cyanidation. In 1930 amalgamation produced gold and silver valued together at $14,565,564, compared with $8,908,961 produced by cyanidation.

QUICKSILVER AND CYANIDE USED

Figures showing the total quantities of quicksilver and cyanide used in the recovery of gold and silver in the United States in 1930 are not available. For details of the use of quicksilver in the amalgamation milling process and of cyanide in the cyanidation process the reader is referred to the mine reports for the several Western States.

A considerable quantity of quicksilver was used at gold dredges in Alaska, California, Colorado, Idaho, and Oregon and at placer mines operated by hydraulicking and sluicing. The following quantities of quicksilver were purchased for use in the States for which figures are available: Arizona, 125 pounds; California, 10,068 pounds; Colorado, 2,005 pounds; Idaho, 565 pounds; Montana, 780 pounds; Nevada, 1,106 pounds; New Mexico, 25 pounds; Oregon, 483 pounds; South Dakota, 12,021 pounds; Washington, 75 pounds; and Wyoming, 130 pounds.

Considerable cyanide is used at flotation mills as well as at gold and silver mills. Cyanide used at gold and silver mills in 1930 was mainly cyanamid (a low grade of cyanide). Considerable sodium cyanide and a small quantity of potassium cyanide were also used. Reduced to the equivalent of 96 to 98 per cent NaCN the following data indicate amounts used at mines in the States for which figures are available: Arizona, 52,600 pounds; California, 102,909 pounds;

Colorado, 316,240 pounds; Idaho, 150 pounds; Montana, 1,400 pounds; Nevada, 758,412 pounds; Oregon, 200 pounds; South Dakota, 382,110 pounds; and Texas, 43,624 pounds. No cyanide was reported as consumed at gold and silver mills in New Mexico, Utah, Washington, or Wyoming, and only 1 mill in Alaska consumed a small quantity of cyanide. The following table gives details of the use of cyanide in eight Western States from 1926 to 1930.

Potassium and sodium cyanide consumed at mills in eight Western States, 1926–1930

State and year	Number of mills using cyanidation process	Ore and old tailings treated (short tons)	Cyanide consumed (pounds) [1]		
			Total	Per ton of ore and old tailings	Per ounce of gold and silver
Arizona:					
1926	10	96, 545	90, 315	0. 94	1. 03
1927	9	102, 932	92, 815	. 90	1. 47
1928	5	30, 948	34, 710	1. 12	1. 02
1929	3	8, 364	20, 000	2. 39	. 975
1930	5	39, 039	52, 600	1. 35	. 96
Colorado:					
1926	3	508, 060	258, 327	. 51	1. 49
1927	2	501, 011	270, 000	. 54	1. 19
1928	2	462, 153	384, 351	. 83	3. 01
1929	2	339, 463	297, 025	. 87	1. 98
1930	2	311, 657	316, 240	1. 01	1. 08
Idaho: [2]					
1927	1	23	(3)	-----------	-----------
1930	1	100	150	1. 50	. 63
Montana:					
1926	6	22, 205	43, 000	1. 94	. 64
1927	4	21, 730	36, 308	1. 67	1. 08
1928	5	47, 637	73, 728	1. 55	3. 86
1929	3	11, 738	15, 664	1. 334	. 728
1930	1	630	1, 400	2. 222	1. 20
Nevada:					
1926	15	717, 582	1, 787, 957	2. 49	. 41
1927	22	446, 869	1, 105, 600	2. 47	. 36
1928	18	527, 511	776, 570	1. 47	. 28
1929	15	490, 650	848, 273	1. 73	. 34
1930	14	486, 030	758, 412	1. 56	. 33
New Mexico: [4]					
1926	1	750	1, 125	1. 50	. 16
South Dakota:					
1926	3	1, 402, 472	299, 672	. 21	2. 35
1927	3	1, 353, 298	312, 626	. 23	2. 03
1928	3	1, 376, 205	335, 675	. 24	3. 18
1929	1	1, 384, 094	353, 859	. 26	2. 54
1930	1	1, 348, 844	382, 110	. 28	2. 16
Texas:					
1926	1	33, 818	24, 375	. 72	. 06
1927	1	48, 190	96, 813	2. 01	. 12
1928	1	57, 475	163, 000	2. 84	. 17
1929	1	54, 644	133, 000	2. 43	. 20
1930	1	24, 985	43, 624	1. 75	. 20

[1] Partly estimated for Arizona, Idaho, Montana, and Nevada.
[2] No consumption reported for 1926, 1928, and 1929.
[3] Quantity small; figures not available.
[4] No consumption reported for 1927, 1928, 1929, and 1930.

REVIEW BY STATES

ALASKA

Gold.—The total estimated production of gold from Alaska mines for the period 1880 to 1930, inclusive, is given by the United States Geological Survey as $389,317,000. The mine production in 1930 was $8,476,000, which was $715,000 more than in 1929. The yield from lode mines decreased from $3,644,000 in 1929 to $3,639,000 in 1930, and that from placer mines increased from $4,117,000 in 1929 to $4,837,000 in 1930. The 27 dredges operated in 1930 produced $3,912,600, compared with an output of $2,932,000 from 30 dredges in 1929. The large increase in the production of gold was due entirely to the operation of large dredges and improved engineering efficiency. The average recovery of gold by the dredges in 1930 was about 39 cents a cubic yard of gravel. The 3,936,000 tons of siliceous ore treated in 1930 yielded an average of $0.93 in gold and silver to the ton. The lode mines yielded 43 per cent of the gold in 1930 (considerably less than in 1929). The Alaska Juneau Gold Mining Co. produced more than 90 per cent of the gold from lode mines. The estimated recovery of gold by dredges for the period from 1903 to the end of 1930 is $42,920,074. The Nome and Fairbanks districts were the largest producers of gold from dredging in 1930.

Silver.—The mine production of silver in Alaska in 1930 was 408,570 ounces, 64,330 ounces less than in 1929. In 1930 copper ore yielded 279,990 ounces, siliceous ore 102,080 ounces, and placer bullion 26,500 ounces. Most of the silver was recovered from copper concentrates shipped to smelters, and the decrease in silver production was due to a smaller output of copper. The silver content of gold bullion is unusually small compared with the gold content.

ARIZONA

Gold.—The mine production of gold from Arizona in 1930 was $3,501,610, of which only $13,057 was from placer mines. Of the production from lode mines copper ore yielded $2,730,476, dry and siliceous ore $692,164, lead-zinc ore $32,777, lead ore $25,698, and copper-lead ore $7,438. Yavapai County produced $1,214,133 in gold, Cochise County $1,000,418, and Mohave County $594,011; none of the other counties produced as much as $250,000. The output of gold from siliceous ores in 1930, chiefly from Mohave County, was double that in 1929. Gold in bullion from ore treated by amalgamation amounted to $11,256 and from that treated by cyanidation to $593,008. The gold recovered from concentrates amounted to $752,939, a decrease of $256,196 from the recovery in 1929. The crude copper ore directly smelted amounted to 2,032,680 tons and yielded an average of about 99.5 cents in gold a ton. The largest producers of gold in Arizona in 1930 were the United Verde, Tom Reed, Calumet and Arizona, Copper Queen, and New Cornelia mines.

Silver.—The mine production of silver in Arizona in 1930 (5,540,732 ounces) was 2,002,551 ounces less than in 1929. The sources of the output of silver were: Copper ore, 4,968,973 ounces; siliceous ore, 186,202 ounces; lead ore, 222,541 ounces; lead-zinc ore, 142,440 ounces; copper-lead ore, 20,491 ounces; and placers, 85 ounces. Yavapai County produced 1,930,906 ounces, Cochise County 1,811,904 ounces, and Pinal County 989,837 ounces. The output in all of these counties was mainly from copper ore. Most of the silver (3,927,374 ounces) was recovered from crude ore smelted. Concentrates smelted yielded 1,572,253 ounces and bullion contained only 26,424 ounces. The largest silver-producing mines were the United Verde, Calumet and Arizona, Magma, Copper Queen, and United Verde Extension.

ARKANSAS, MISSOURI, OKLAHOMA, ILLINOIS, AND KENTUCKY

The lead, zinc, and lead-zinc mines of the Central States do not report any recovery of gold, and only a few of them report any silver. None of the zinc ores in the Central States yield any silver, and no silver is recovered from lead or zinc concentrates; however, some of the lead concentrates from the Joplin region contain a small quantity of silver. The copper ore of southeastern Missouri contains some silver, but no copper ore has been shipped for several years. All the silver from southeastern Missouri in 1930 (170,210 ounces) was derived from lead ore. Formerly, the larger part of this silver was obtained in refining lead bullion or from copper-lead matte shipped to smelters. This source, however, has become almost negligible. Nearly all the silver in 1930, as in 1929, was obtained from residues of zinc concentrates derived from lead ores concentrated. These residues are shipped to lead smelters after being treated at zinc smelters. The zinc concentrates from southeastern Missouri contain the unusually large silver content of 18 to 20 ounces a ton, which is much greater than that contained in the great bulk of zinc concentrates from the Western States. The lead-fluorspar deposits of the Illinois-Kentucky region carry silver, and 1,797 ounces of silver were recovered from lead concentrates shipped from Illinois in 1930. The mines in Arkansas and Oklahoma, which formerly yielded some silver, were idle or abandoned, and no silver was reported in either 1929 or 1930.

CALIFORNIA

Gold.—The total production of gold from California mines for the period 1848 to 1930, inclusive, is recorded as $1,841,540,225, of which $1,234,541,154 was from placer mines. In 1930 the lode mines produced $5,696,019 (an increase of $1,039,923), of which gold quartz yielded 90 per cent; placers yielded $3,755,143 (a decrease of $115,464). Of the placer production of gold, $3,451,801 (92 per cent) was recovered by 24 gold dredges. The total gold produced by dredging from 1896 to 1930, inclusive, was $167,005,744. Nine dredges in Sacramento County produced $1,722,017 in gold; 6 dredges in Yuba County, $949,002; and 3 dredges in Trinity County, $251,909. Dredges were also operated in Amador, Butte, Calaveras, Merced, Shasta, and Stanislaus Counties. Only three counties in California had gold output exceeding $1,000,000 in 1930; and these were, in order of rank, Nevada, Amador, and Sacramento. Most of the gold recovered from mines in Amador and Nevada Counties was from siliceous ores. The five Mother Lode counties—Amador, Calaveras, Eldorado, Mariposa, and Tuolumne—whose output is mainly gold milling ore, produced from that source 91,673 ounces of gold in 1930, compared with 83,971 ounces in 1929. The largest producers of gold in California in 1930 were the Empire Star Mines Co. (Ltd.), Natomas Co., Yuba Consolidated Gold Fields, Kennedy Mining & Milling Co., Argonaut Mining Co., Original Sixteen to One Mines (Inc.), Central Eureka Mining Co., and Capital Dredging Co.

Silver.—The total silver production of California for the period 1848 to 1930, inclusive, is recorded as 84,536,750 fine ounces. The silver produced in 1930 was 1,622,803 ounces, 445,908 ounces more than in 1929. The 1930 output of silver was derived from the following sources: Placer bullion, 12,626 ounces; dry and siliceous ore, 823,000 ounces; copper ore, 670,398 ounces; and lead ore, 116,779 ounces. Most of the silver was from mines in San Bernardino, Plumas, Napa, and Inyo Counties, and only three mines produced more than 100,000 ounces each. The largest producers of silver in 1930 were the Wortley Consolidated Mines (Inc.), Walker Mining Co., and Banner Development Co. Most of the silver was contained in concentrates shipped to smelters.

COLORADO

The total production of gold from Colorado mines for the period 1858 to 1930, inclusive, is recorded as $715,479,032 and that of silver as 657,931,919 fine ounces.

Gold.—The mine production of gold in Colorado in 1930 was $4,517,619, an increase of about $100,000 compared with 1929. The Cripple Creek district in Teller County produced $2,532,032; that part of the San Juan region including Dolores, La Plata, Ouray, Rio Grande, San Juan, and San Miguel Counties, $881,943; Lake County, $104,276; Summit County, $137,306; Eagle County, $117,133; and Gilpin County, $139,710. Gold yield from placer mines was only $138,243 and that from lode mines $4,379,376. A dredge in Summit County produced most of the gold accredited to placers. Dry and siliceous ore yielded 194,374 fine ounces of gold (89 per cent of the total output). Lead-zinc ore yielded about 5 per cent, lead ore about 1 per cent, and copper ore 2 per cent. The quantity of gold recovered by amalgamation and cyanidation was 146,796 ounces, that contained in concentrates was 40,857 ounces, and that in crude ore shipped to smelters was 24,200 ounces.

Silver.—The output of silver from Colorado mines in 1930 was 4,382,852 ounces (14,525 ounces less than in 1929). Of this output mines in Lake County produced 616,800 ounces; mines in the San Juan region, including Mineral and Saguache Counties, 1,988,826 ounces; and those in Eagle County, 1,620,574 ounces. Siliceous and dry ores yielded 1,628,152 ounces, lead ore 176,054 ounces, lead-zinc ore 1,090,400 ounces, copper ore 1,484,589 ounces, and placer bullion 1,657 ounces. Only 204,268 ounces of silver were recovered in bullion at gold and silver mills; 2,159,680 ounces came from crude ore shipped to smelters. Silver derived from concentrates amounted to 2,017,247 ounces, mainly from San Juan, Saguache, and Lake Counties.

IDAHO

The total production of gold in Idaho from the discovery of placer gold in 1863 to the end of 1930 is estimated at $137,510,199 and the total output of silver for the same period at 326,448,018 ounces.

Gold.—Of the total output of gold in Idaho in 1930 ($443,309), Boise County produced $274,093 and Idaho County $78,267. The yield of gold from placer mines was $82,428, and that from lode mines was $360,881. Of the placer gold $68,527 was recovered by three dredges. The total value of the gold recovered by dredges during the period 1897 to 1930, inclusive, was $6,155,602. Dry and siliceous ores, chiefly gold ore, yielded $294,424, lead-zinc ore $27,508, lead ore $22,197, and copper ore $16,752. Gold and silver mills recovered 12,615 fine ounces of gold by amalgamation and less than 3 ounces by cyanidation. The largest producers of gold in Idaho in 1930 were the Talache, Idawa, and Sherman Howe mines and the Idaho Gold Dredging Corporation.

Silver.—Of the 1930 output of silver (9,420,639 ounces) 8,831,461 ounces were from the Coeur d'Alene region in Shoshone County and 199,203 ounces from mines in Blaine County. Lead ore yielded 4,462,368 ounces, lead-zinc ore 2,258,124 ounces, copper-lead ore 2,635,993 ounces, siliceous ore 35,737 ounces, copper ore 26,262 ounces, zinc ore 800 ounces, and placer mines 1,355 ounces. Concentrates shipped yielded 8,802,773 ounces and crude ore shipped to smelters 612,714 ounces. Only 5,152 ounces of silver were obtained from mill and placer bullion. The larger producers of silver in 1930 were the Sunshine, Bunker Hill & Sullivan, Hecla, and Morning mines, all in Shoshone County.

MICHIGAN

The copper mines of Michigan have been large producers of silver, of which part was recovered in lumps and the remainder in the electrolytic refining of copper bullion. Apparently no bullion was refined in 1930, so that the only output of silver was 7,820 fine ounces contained in lumps of native silver sold to refineries.

MONTANA

The total production of gold from Montana for the period 1904 to 1930, inclusive, is recorded as $76,808,835 and the total silver production for the same period as 332,163,474 ounces.

Gold.—The output of gold from placer mines was only $14,899; no dredges were operated in 1930. The total gold from mines in Montana in 1930 was $899,001, a decrease of $232,948 from 1929. The output from lode mines ($884,102) showed a decrease of $235,513, due mainly to the lessened output of the Anaconda group of properties at Butte. Silver Bow County, with $268,188 in 1930, lost first place as a producer of gold to Lewis and Clark County, which had an output of $291,610. Madison County mines yielded $244,918 in gold, and no other county in Montana produced more than $25,000 in 1930. The lode gold was derived mainly from copper ore, which yielded $448,903; the remainder was divided between siliceous ore ($366,974) and other classes of ore combined ($68,225). At amalgamation and cyanidation plants 1,335 ounces of gold were recovered. Concentrates from all sources yielded 37,575 ounces of gold and crude ore shipped to smelters 3,622 ounces. Nearly 80 per cent of the gold output in 1930 was from the Spring Hill, Anaconda group, and Liberty Montana mines.

Silver.—The total production of silver from Montana mines in 1930 (7,052,889 ounces) was 5,664,088 ounces less than in 1929. Copper ore yielded 4,583,827 ounces (2,705,180 less than in 1929), lead-zinc ore 1,261,859 ounces, siliceous ore 657,439, zinc ore 449,183, lead ore 91,635, copper-lead ore 8,860, and placer mines 86 ounces. Silver Bow County produced 5,257,545 ounces (about 4,660,000 less than in 1929). Judith Basin and Flathead Counties were the only others to produce more than 500,000 ounces in 1930. Bullion from cyanidation and amalgamation mills yielded only 1,707 ounces of silver. Concentrates from all sources, mainly copper and zinc concentrates, yielded 5,590,350 ounces and crude smelting ore 1,410,149 ounces.

The 486,715 tons of concentrates recovered in Montana in 1930 yielded an average of 11.5 ounces of silver a ton. Nearly 82 per cent of all the silver was from the Anaconda group, Block P, and the Butte & Superior mines.

NEVADA

The total production of gold in Nevada from 1904 to 1930, inclusive, is recorded as $212,292,913 and the total silver production as 250,216,682 ounces.

Gold.—The mine production of gold in Nevada in 1930 was $3,081,436, $302,775 less than in 1929. The placer mines produced only $38,438; no gold dredges were operated. The larger producing counties were White Pine, with $1,062,115; Esmeralda, with $652,499; Elko, with $469,486; and Nye, with $446,344. The output of gold from White Pine County, which is derived mainly from copper ore, declined $268,746. The total gold from siliceous ore was $1,923,132, or more than 62 per cent of the total State yield; gold from copper ore was nearly 34 per cent and that from placers and all other base ores nearly 4 per cent of the State total. The larger gold-producing mines in 1930 were the Nevada Consolidated, Elkoro, Tonopah Extension, Goldfield Consolidated (tailings), and Consolidated Coppermines.

Silver.—The mine production of silver in Nevada in 1930 was 4,219,832 ounces, 703,694 less than in 1929. The Tonopah district produced 1,931,194 ounces, about 34,400 less than in 1929. Esmeralda County produced 1,433,961 ounces, an increase of about 659,800 over the output in 1929. Storey County (old Comstock) produced only 25,296 ounces, the smallest output for many years. Dry and siliceous ores yielded 2,478,009 ounces, lead-zinc ore 1,063,639, copper ores 270,512, lead ore 148,033, copper-lead ore 258,792, and placer bullion 847 ounces. Nearly 53 per cent of the silver was recovered by cyanidation, 34 per cent from concentrates, and 12 per cent from crude ore shipped to smelters. The four largest producers of silver in 1930 were the Tonopah Extension, Treadwell Yukon, Combined Metals, and Bristol Silver mines.

NEW MEXICO

Gold.—The gold produced by mines in New Mexico in 1930 was $669,156, $58,006 less than in 1929. The gold output of San Miguel County was $271,127, most of the gold being recovered from lead-zinc ore concentrated at the Pecos mill near Glorieta. The production in Hidalgo County was $289,943 and that in Grant County $79,300. Copper ore yielded 17,139 ounces of gold, lead-zinc ore 13,229, dry and siliceous ore 1,878, lead ore 61, and placers nearly 64 ounces. Concentrates of various kinds yielded 17,673 ounces of gold and crude ore shipped to smelters 14,598 ounces.

Silver.—The mine production of silver in New Mexico decreased from 1,121,546 ounces in 1929 to 1,107,335 in 1930. Grant County, San Miguel County, and Hidalgo County were the only counties that had an output of more than 100,000 ounces. Siliceous ore yielded 111,801 ounces, copper ore 228,494, lead-zinc ore 744,676, lead ore 22,346, and placer mines 18 ounces. Concentrates yielded 871,402 ounces of silver and crude ore shipped to smelters 235,673 ounces.

OREGON

Gold.—The production of gold from mines in Oregon in 1930 was $297,702, $55,621 less than in 1929. The output from lode mines was $83,283, a decrease of $23,071 from that in 1929. The placer mines produced $214,419 in gold, of which dredges in Baker, Grant, and Jackson Counties yielded $174,470. Jackson County had the largest output of gold, $110,824, and Grant County mines yielded $104,842. Lode and placer mines in the Western district yielded $171,425 in gold and those in the Eastern district, $126,277. Only 112 ounces of gold were derived from copper ores.

Silver.—Of the total output of silver (9,000 ounces) in Oregon in 1930, 6,269 ounces came from dry and siliceous ore, 1,050 ounces from copper ore, 102 ounces from lead-zinc ore, and 1,579 ounces from placer bullion.

SOUTH DAKOTA

The total value of gold produced in South Dakota from 1875 to 1930, inclusive, is recorded as $289,223,731 and the total output of silver for the same period as 7,770,064 ounces.

Gold.—The mine production of gold in South Dakota in 1930 was $8,418,008, or $1,868,409 more than in 1929. Almost the entire output was from low-grade siliceous ore. In 1930, as in other years, most of the gold and silver was the output of the Homestake mine. The mills at this property recovered gold-silver bullion valued at $8,426,195, and the ore reserves are reported to be 14,981,911 tons. The Keystone Consolidated Mines Co. (Inc.), near Keystone, operated its 100-ton cyanide plant for a brief period. Only 47 ounces of gold was recovered from placers.

Silver.—The output of silver from South Dakota mines in 1930 was 105,236 ounces, of which all except 5 ounces was derived from siliceous ore.

SOUTHERN APPALACHIAN AND EASTERN STATES

Gold.—The total production of gold in the Southern Appalachian States from 1799 to the end of 1930, as shown by data compiled by the Bureau of the Mint and the Bureau of Mines, is $51,204,377. The data compiled credit Alabama with $767,399, Georgia with $17,851,852, Maryland with $71,405, North Carolina with $23,683,089, South Carolina with $5,182,815, Tennessee with $349,381, and Virginia with $3,298,436. The mine production of gold in the Eastern and the Southern Appalachian States increased from $36,793 in 1929 to $46,637 in 1930. Gold was produced in 1930 in the following States: Alabama $450, Georgia $4,194, North Carolina $14,582, Pennsylvania $13,023, and Tennessee $14,388. Small placer mines in Alabama, Georgia, and North Carolina yielded $1,686. Dry and siliceous ore milled in Georgia and North Carolina yielded $6,740 in gold; copper ore from North Carolina and Tennessee yielded $25,188; and pyritiferous magnetite ore from Pennsylvania yielded $13,023. No gold was recovered from lead-zinc or zinc ores. Gold recovered from base ores in 1930 was nearly five times that recovered from placers and gold ore.

Silver.—Siliceous ore and placer bullion yielded only 80 ounces of silver in 1930. Copper ore from Tennessee, North Carolina, and

Vermont yielded 117,748 ounces and copper concentrates derived from pyritiferous magnetite ore mined in Pennsylvania 5,762 ounces. These concentrates contained less than 1 ounce of silver per ton.

TEXAS

The total output of gold from Texas mines from 1885 to 1930, inclusive, is recorded as $95,073 and the output of silver for the same period as 22,772,523 ounces.

Gold.—The production of gold has been almost entirely a by-product. The mine output in 1930 was $3,648, compared with $26,439 in 1929.

Silver.—The mine production of silver in Texas decreased from 1,020,516 ounces in 1929 to 389,239 in 1930. This substantial decrease was due mainly to the closing of the Presidio mine at Shafter on June 30, 1930. This mine, which has been worked almost continuously since 1883, produced only about one-third as much in 1930 as in 1928. The World Exploration Co. operated its 100-ton flotation plant at the Hazel mine in Culberson County from May 1 to October 1, 1930; but operations were unprofitable, and the plant was closed. Unless prices of silver, copper, and lead advance considerably the mines in Texas will be very small producers in 1931.

UTAH

The total output of gold from Utah mines from 1864 to the end of 1930 is recorded as $135,549,002 and the total output of silver for the same period as 577,184,210 ounces.

Gold.—In 1930 the mine production of gold, all from lode mines, was $4,309,148, a decrease of $660,767 from that in 1929. The Tintic district yielded $1,649,141 of the 1930 production, the Bingham or West Mountain district $2,187,614, and the Park City region $360,282. The output of gold from the Tintic district increased more than $630,000; that from the Bingham district decreased more than $1,140,000. Copper ore yielded $1,673,453 in gold; siliceous ore, $1,431,589; lead-zinc ore, $745,665; lead ore, $406,413; and copper-lead ore, $52,028. The increased output of gold from the Tintic district was due to the large yield from siliceous gold ore. Concentrates shipped yielded $2,287,344 and crude smelting ore $1,948,294. No bullion was reported as produced at gold and silver mills in 1930. The five largest producers of gold in 1930 were the mines of the Utah Copper, Eureka Standard, North Lily, United States Smelting, Refining & Mining at Bingham, and Park Utah Consolidated companies.

Silver.—The mine production of silver in Utah decreased from 17,592,396 ounces in 1929 to 13,129,421 in 1930, but Utah remained the leading producer of silver. Five counties each produced more than 1,500,000 ounces of silver. Mines in the Tintic district yielded 4,834,829 ounces, those in the Bingham district 3,517,117, and those in the Park City region 4,212,403 ounces; all three districts showed a much smaller output of silver in 1930 than in 1929. Separated as to source, lead-zinc ore supplied 6,479,433 ounces, lead ore 3,362,487, dry and siliceous ore 2,215,920, copper ore 944,113, and copper-lead ore 127,468 ounces. First-class crude shipping ore yielded 4,671,750 ounces, concentrates 8,193,168, and other material including old tailings smelted 264,503 ounces. The Tintic Standard and Silver King Coalition mines were the largest producers of silver.

WASHINGTON

The total production of gold in Washington from 1860 to the end of 1930 is recorded as $30,422,745 and the total production of silver as 9,284,680 ounces.

Gold.—The mine production of gold in Washington increased from $76,898 in 1929 to $87,748 in 1930. The output was the second lowest since that in 1884. Mines in Whatcom County produced $71,744, and the output from mines in the seven other counties aggregated $16,004. Nearly all the mines in the Republic district in Ferry County, which formerly produced most of the gold, were idle in 1930. The only large producer of gold in 1930 was the Boundary Red Mountain mine in Whatcom County, which had an output of 29 per cent more gold than in 1929. Small placer mines yielded $3,946 and copper and lead ores $2,083; the remainder of the gold was from siliceous ore treated mainly by amalgamation. Crude ore shipped yielded $10,148 in gold.

Silver.—The output of silver from mines in Washington decreased from 47,182 ounces in 1929 to 32,816 in 1930. Of the 1930 output 19,454 ounces were from Stevens County and 9,277 from Snohomish County. The 1930 output of silver was the smallest since 1894, due to the continued idleness of mines in the Republic district. The sources of the silver were as follows: Copper ore, 27,592 ounces; lead ore, 2,435; siliceous ore, 1,726; lead-zinc ore, 1,020; and placer bullion, 43 ounces. Crude ore supplied 20,580 ounces, concentrates 11,983, and amalgamation 173 ounces. The United Copper and Sunset mines were the largest producers of silver.

WYOMING

The total production of gold from mines in Wyoming from 1867 to the end of 1930 is recorded as $1,249,654 and that of silver for the same period as 70,319 ounces.

Gold.—The mine production of gold in 1930 was 443 ounces, compared with 48 in 1929. The increase was due chiefly to the operation of amalgamation-concentration mills at Atlantic City, Fremont County. A small quantity of gold bullion and concentrates was shipped from the mill at the Gold Nugget property in the Copper Mountain district, Fremont County.

Silver.—The silver output of Wyoming mines was 122 ounces in 1930, compared with 26 in 1929.

PHILIPPINE ISLANDS

Gold.—The output of gold in the Philippine Islands from 1907 to 1930, inclusive, is recorded as $32,299,995. The production during the last 10 years was as follows:

1921	$1, 313, 096	1926	$1, 925, 188
1922	1, 526, 400	1927	1, 686, 231
1923	1, 686, 327	1928	1, 904, 062
1924	1, 651, 796	1929	3, 320, 300
1925	1, 945, 990	1930	3, 704, 800

The lode mines yielded $3,696,573 from siliceous ore in 1930 and the small placer mines $8,227. No base ores were treated, and the entire output of silver (110,278 ounces) was from bullion recovered at mills (except 8 ounces from placers). The Baguio district in Mountain Province has been the largest producer of gold since 1921. It has 90 patented claims and 277 claims held by assessment. The three large producing properties are the Benguet, Balatoc, and Itogon. Smaller properties worked by natives and white prospectors yield about $125,000 in gold yearly.

The ore reserves of the three large producers are estimated at about 878,000 tons, or about enough to supply their cyanidation plants for 5 years.

The Balatoc mill is now rated at 300 tons daily; and the output of gold has increased greatly, although the recovery per ton of ore decreased from $28.36 in 1929 to $23.97 in 1930. The Benguet Consolidated Mining Co. has developed ore on the 600, 700, 800, and 900 foot levels and has the Hartwell group under development. In 1930 the Itogon Mining Co. used a new leaching plant of 1,000 tons capacity a month to treat ore too low in grade to send to the all-sliming cyanide plant.

The Baguio Gold Mining Co. has done prospecting work on 28 claims preparatory to building a mill. The Kelly mines were worked by natives who recovered gold by panning. In the Masbate district the Panique Syndicate and Geringer Ashurst & Co. properties were producers in 1930. The Syndicate Mining Co. ceased operating in 1931; and its property was sold to Paul Schwab, who will operate on a smaller scale. The Panique property is equipped with a 50-ton mill which recovers 60 per cent of the bullion by amalgamation and the remainder by leaching. Geringer Ashurst & Co. has a 50-ton mill which was built in 1928. The Tenago mine is equipped with a 3-stamp mill, which was idle in 1930.

The following papers have been prepared by the Division of Geology and Mines of the Bureau of Science, Manila, P. I.: Report of the Anget Mineral District, by Q. A. Abadilla; The Masbate Mineral District, by Ramon F. Abarquez; The Tumbaga Gold Mines, by A. D. Alvir and L. F. Abad; and The Baguio Mining District, by L. F. Abad. These reports are available for consultation in manuscript form. Other information regarding gold mines is given in the yearly reports of Mineral Resources of the Philippine Islands issued by the Bureau of Science, Manila, P. I.

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MINERAL PRODUCTION OF THE WORLD, 1924–1929[1]

(A STATISTICAL SUMMARY)

By L. M. Jones[2]

CONTENTS

	Page
Introduction	860
Abyssinia (see Ethiopia).	
Aden	860
Afghanistan	860
Albania	861
Algeria	862
Angaur Island (Japanese Oceania)	862
Anglo-Egyptian Sudan	863
Arabia	863
Argentina	864
Australia	864
Austria	872
Basutoland	873
Bechuanaland Protectorate	873
Belgian Congo	873
Belgium	874
Bermuda Islands	875
Bolivia	875
Brazil	876
British Borneo	876
British Guiana	877
British Honduras	877
British West Africa	877
British West Indies	877
Bulgaria	879
Canada	879
Ceylon	885
Chile	886
China	887
Colombia	888
Costa Rica	889
Cuba	889
Cyprus	890
Czechoslovakia	890
Denmark	891
Dominican Republic	892
Ecuador	892
Egypt	892
Eritrea	893
Estonia	893
Ethiopia	893
Finland	894
France	895
French Equatorial Africa (Congo)	897
French Guiana	897
French West Africa	897
French West Indies	898
Germany	898
Gold Coast and Ashanti	903
Greece	903
Greenland	904
Guatemala	904
Haiti	905
Honduras	905
Hungary	905
Iceland	906
India (British)	906
Indo-China	908
Iraq	908
Irish Free State	908
Italy	909
Japan (including Chosen, Karafuto, and Taiwan)	911
Kenya Colony and Protectorate	913
Latvia	914
Liberia	914
Libia Italiana (Cyrenaica and Tripolitania)	914
Lithuania	914
Luxemburg	915
Madagascar	915
Makatea Island (French Oceania)	916
Malay States	916
Federated States	916
Straits Settlements	917
Unfederated States	917
Malta	917
Mauritius	918
Mexico	918
Morocco	919
Nauru and Ocean Islands	920
Netherlands	920
Netherland East Indies	921
Netherland West Indies	921
New Caledonia	922
Newfoundland	922
New Guinea, Territory of	922
New Zealand	923
Nicaragua	923
Nigeria	923
Norway	924
Nyasaland Protectorate	924
Palestine (including Trans-Jordan)	925
Panama	926
Papua	926
Paraguay	926
Persia	927
Peru	928
Philippine Islands	928
Poland	929
Portugal	929
Portuguese East Africa (Mozambique)	930
Portuguese East Indies (Timor)	931
Portuguese India (Gôa)	931
Portuguese West Africa	931
Rhodesia	932
Rumania	932
Russia	933
Salvador	938
Seychelles Islands	938
Siam	938
Sierra Leone	938
Somaliland	939
South-West Africa	939
Spain	940
Surinam (Dutch Guiana)	941
Svalbard (Spitsbergen)	942
Swaziland	942
Sweden	942
Switzerland	944
Syria	945
Tanganyika Territory	945
Trinidad	946
Tunisia	946
Turkey	946
Uganda Protectorate	948
Union of South Africa	948
United Kingdom (Great Britain and Northern Ireland)	951
United States of America	956
Uruguay	960
Venezuela	961
Yugoslavia	962
Zanzibar Protectorate	962

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[1] Work on manuscript completed May, 1932.

[2] The assistance of M. T. Latus, of the Bureau of Mines, is gratefully acknowledged.

INTRODUCTION

The following statistical review presents as briefly as possible a comprehensive statement of the mineral production of the world, by countries, for the years 1924 to 1929, inclusive, and continues the series which began with the year 1919. So far as possible the mineral products enumerated have been restricted to the primary form in which the mineral first comes upon the market, for if the mineral industry were followed throughout its more extended ramifications the present work would have inconvenient proportions.

For some countries no data of actual output are available, and the exports of mineral products have been given as an indication of the country's mineral possibilities; for others, where neither production nor exports could be ascertained, a brief résumé of the reputed mineral deposits has been given.

The quantities are stated in metric units, the figures as reported having been converted by the use of the factors listed below. As a rule, the metric equivalents corresponding most nearly to the original units have been used—for example, pounds have been converted to kilograms.

1 ton (long, statute)	1.01605 metric tons.
1 ton (short)	0.90718 metric ton.
1 hundredweight (British)	0.05080208 metric ton or 50.80208 kilograms.
1 pound, avoirdupois	0.45359 kilogram.
1 ounce, troy	0.03110348 kilogram or 31.103481 grams.
1 gallon, imperial	0.045436 hectoliter or 4.5436 liters.
1 gallon, U. S	0.03785332 hectoliter or 3.785332 liters.
1 cubic foot	0.028317016 cubic meter.
1 bushel (lime)	0.0317513 metric ton.
1 pikol (Netherland East Indies)	0.0617613 metric ton.
1 picul (China, Siam, Federated and Unfederated Malay States, Straits Settlements)	0.06047866 metric ton.
1 picul (Japan)	0.06 metric ton.
1 kin (Japan)	0.0006 metric ton or 0.6 kilogram.
1 kwan (Japan)	0.00375 metric ton or 3.75 kilograms.
1 momme (Japan)	3.75 grams.
1 koku (Japan)	1.80391 hectoliters.
1 cubic shaku (Japan)	0.02783 cubic meter.

ADEN

No mineral deposits are known in Aden, and the production of salt by the evaporation of sea water is the only mineral industry of the country. The output of salt is reported as follows for the years under review:[3] 1924, 182,058 tons; 1925, 191,518 tons; 1926, 197,646 tons; 1927, 184,674 tons; 1928, 226,346 tons; 1929, 250,195 tons.

AFGHANISTAN [4]

Although attempts to mine the ores and gem stones of Afghanistan date back to remote antiquity, the mineral industry of the country remains commercially undeveloped. Two factors hinder the growth of mining: (1) Geologically the deposits are very dislocated; and (2) traffic conditions are so bad that until improvement is made, lucrative mining seems out of the question. No data of mineral production are available.

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[3] India, Geological Survey Records: Calcutta (annual).

[4] Herbordt, O., Über nutzbare Lagerstätten in Afghanistan: Ztschr. prakt. Geol., Jahrg. 33, 1925, pp. 193-198; Ferrari, A., Spedizione mineraria italiana nell' Afghanistan settentrionale: La Miniera Italiana, vol. 7, 1923, pp. 100-107; Trinkler, E., Afghanistan: Petermann's Mitt., Ergänzungsheft 196, 1928, pp. 75-76; Information supplied by the American consulate, Karachi, India, Dec. 10, 1931.

Deposits of antimony, asbestos, coal, copper, gem stones (rubies and lapis lazuli), gold, iron, lead, mica, oil shale, petroleum, platinum, pyrites (copper and iron), rock salt, silver-lead, and sulphur are known. The lapis lazuli of Badakshan has long been in high repute. A gold mine near Kandahar is worked under British supervision, and natives work placers crudely at various localities. Except for these minor industries no mining is known.

ALBANIA

Although Albania has not as yet been thoroughly prospected, the work is progressing under the Albanian Mining Bureau, recently organized by the Italian engineer, A. Moschetti, and present knowledge leads to the conclusion that the mineral resources are considerable.

The country may be divided roughly into two mineral zones, the northern and southern, of which the former is the more important. The economic minerals [5] known to occur in more or less workable quantities are alunite, arsenic (realgar and orpiment), asbestos, asphalt, bauxite, chromite, clay, coal (lignite), copper, gold, gypsum, iron, magnesite, natural gas, petroleum, pyrite, salt, limestone, marl, and sandstone.

Some of the metalliferous deposits of Albania were worked before and during the era of the Roman Empire, but few traces remain of the old workings. Asphalt has been mined at Selenitza, in the Province of Vallona, since Roman times. The occurrence of asbestos and magnesite is widespread, but few of the deposits are exploited even by primitive methods. Bauxite is reported from numerous places in the coastal area, where it occurs as the final product of the weathering of Cretaceous limestone and is similar in origin to the well-known deposits of Dalmatia and Istria. In the coastal area promising petroleum indications are also found, and the region is now being drilled by French, Italian, and English oil companies. Lignite deposits are widespread, but most of them are of only local importance. The principal deposits are those around Lake Ochrida and near the town of Korça. Large beds of gypsum are widely distributed.

The only available statistics of mineral production relate to asphalt, lignite, petroleum, and salt and are as follows:

Mineral production of Albania, 1924–1929, in metric tons [a]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt	5, 296	3, 164	3, 860	3, 283	2, 277	2, 512
Coal (lignite)	(b)	400	1, 558	3, 115	2, 985	4, 117
Petroleum [c]	--------	--------	1, 000	1, 500	2, 620	3, 060
Salt	(b)	(b)	5, 596	6, 600	5, 283	(b)

[a] Source of data: Moschetti, A., Le minière in Albania; information furnished by the American Legation Tirana.

[b] Data not available.

[c] Output used at mines and in the treatment of asphalt at Selenitza.

[5] Baldacci, A., L'Albanie minière: Echo des Mines, No. 3046, Paris, Nov. 1, 1930, pp. 917–922. Moschetti, A., Le minière in Albania: L'Industria Mineraria, vol. 4, No. 9, Rome, 1930, pp. 409–432. Nowack, E., Die nutzbaren Mineralvorkommen Albaniens: Montan. Rundschau, Jahrg. 16, Vienna, 1924, pp. 695–697. Nowack, E., Der nordalbanische Erzbezirk: Abhandl. zur prakt. Geol. u. Bergwirtschaftslehre, vol. 5, Halle a. S., 1926, 32 pp. Wray, D. A., The Geology and Mineral Wealth of Albania and Macedonia: Min. Mag. (London), vol. 32, No. 6, 1925, pp. 329–339.

ALGERIA

Mineral production of Algeria, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Diatomite [2] ....tons	9,092	8,343	7,931	9,542	10,144	11,734
Antimony ore [3] ....do	2,450	1,787	1,027	283	[2] 56	[2] 310
Barite ....do	500	600	800	500	....	1,200
Briquets, fuel ....do	79,265	74,495	57,442	83,338	33,767	101,552
Cement ....do	39,329	49,487	60,544	45,442	51,699	57,660
Clay:						
Fire clay ....do	....	....	400	....	....	....
Kaolin ....do	1,260	2,400	2,000	2,500	1,666	1,366
Other clay ....do	179,605	197,115	180,845	197,710	289,330	367,650
Coal: Bituminous ....do	9,228	10,037	13,731	21,269	16,631	16,130
Coke, gas-house ....do	38,629	34,509	35,131	(4)	31,619	48,663
Coke by-products:						
Ammonium sulphate ....do	314	280	289	(4)	483	569
Tar, crude ....do	3,490	3,794	3,907	(4)	4,128	4,331
Copper ore [5]	3,110	2,598	2,573	1,516	2,021	550
Gypsum:						
Alabaster ....do	100	2	10	12	74	225
Other gypsum ....do	54,374	72,840	74,060	74,500	79,800	106,996
Iron ore [6] ....do	1,662,506	1,780,842	1,629,425	2,004,189	985,626	2,196,182
Lead arsenate [7] ....do	9,335	6,750	3,665	2,482	1,201	2,541
Lead ore [8] ....do	15,986	17,513	14,077	15,098	13,409	14,227
Lime:						
Hydraulic ....do	94,838	90,867	107,175	75,552	92,585	90,960
Other ....do	(4)	36,900	(4)	(4)	(4)	(4)
Manganese ore [2] ....do	406	450	577	3,817	1,476	450
Mercury:						
Ore ....do	1,120	750	1,231	1,355	....	1,930
Metallic ....kilograms	2,729	1,897	2,559	1,042	....	4,239
Petroleum, crude ....tons	1,737	1,882	1,429	1,204	1,224	3,048
Phosphate rock ....do	681,136	815,116	929,355	919,108	875,947	747,035
Pyrite, iron ....do	17,870	12,566	11,505	12,918	13,825	16,804
Salt ....do	23,541	27,095	43,216	36,936	10,975	15,305
Sand and gravel ....do	41,000	62,000	62,000	62,400	67,500	70,000
Stone:						
Building stone, dressed ....do	17,150	13,700	14,700	15,200	16,900	16,000
Limestone—						
For agriculture ....do	14,950	16,400	15,350	12,750	18,200	22,680
For other purposes [9] ....do	207,130	239,438	247,610	201,909	279,750	287,135
Marble [10] ....do	685	1,567	2,580	3,483	4,068	3,890
Other stone ....do	2,075,725	1,383,790	2,135,602	1,975,590	2,143,970	2,397,250
Zinc ore [11] ....do	42,759	56,181	62,154	47,830	32,308	32,575
Zinc-lead ore [12] ....do	....	575	473	110	2,664	2,030

[1] Source of data: Statistique de l'Industrie Minérale et des Appareils à Vapeur en France et en Algérie; Bull. Comparatif Trimes. du Mouvement Com. et Maritime; data furnished by the Direction des Mines, Algeria.

[2] Exports.

[3] Average antimony content reported as follows: 1924, 40 per cent; 1925, 39 per cent; 1926, 49 per cent; 1927, 46 per cent. No production is reported for 1928 or 1929. Contents of exports not stated

[4] Data not available.

[5] Average content reported as follows: 1924, Cu 18 per cent; 1925, Cu 18 per cent; Ag 950 grams per ton; 1926, Cu 19 per cent, Ag 2,500 grams per ton; 1927, Cu 18 per cent, Ag 2,000 grams per ton; 1928, Cu 11.4 per cent; 1929, Cu 4.55 per cent.

[6] Figures as reported by Direction des Mines, Algeria; figures given in Statistique de l'ind. min., Paris, are as follows: 1924, 1,661,906 tons; 1925, 1,780,542 tons; 1926, 1,630,000 tons; 1927, 2,004,200 tons; 1928, 1,985,500 tons; 1929, 2,196,200 tons.

[7] Average content reported as follows: 1924 and 1925, Pb 17 per cent, As 17 per cent; 1926, Pb 15 per cent, As 20 per cent; 1927, Pb 15 per cent, As 22 per cent; 1928 and 1929, Pb 25 per cent, As 12 per cent.

[8] Average content reported as follows: 1924, Pb 54 per cent, Ag 483 grams per ton; 1925, Pb 57 per cent, Ag 400 grams per ton; 1926 and 1927, Pb 57 per cent, Ag 330 grams per ton; 1928, Pb 56 per cent, Ag 370 grams per ton; 1929, Pb 56 per cent, Ag 365 grams per ton.

[9] Exclusive of dressed building stone.

[10] Includes onyx.

[11] Average zinc content reported as follows: 1924, 41.7 per cent; 1925–1929, inclusive, 45 per cent.

[12] Average content reported as follows: 1925, Zn 40 per cent, Pb 16 per cent; 1926, Zn 21 per cent, Pb 12 per cent; 1927–28, inclusive, Zn 21 per cent, Pb 20 per cent; 1929, Zn 14 per cent, Pb 18.5 per cent.

ANGAUR ISLAND (JAPANESE OCEANIA) [6]

Mining of phosphate rock is the only mineral industry of Angaur Island, now a part of the Japanese mandate territory in Oceania. The output is exported to Japan. Exports for the fiscal year ended March 31 (of the year following that stated) are reported as follows for 1924 to 1929, inclusive: 1924, 61,631 tons; 1925, 66,921 tons; 1926, 63,922 tons; 1927, 64,141 tons; 1928, 65,358 tons; 1929, 65,494 tons.

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[6] Information supplied by the American consulate, Tokyo.

ANGLO-EGYPTIAN SUDAN [7]

So far as known, the mineral resources of the Anglo-Egyptian Sudan are not extensive, and at present only gold and salt are worked commercially.

The two most important gold mines, the Gebeit and Oyo mines, are in Kassala Province. Lignite of rather poor quality occurs in Dongola, but no workable deposits have been reported. Large deposits of copper are known in the Province of Bahr el Ghazal. The mines were worked for centuries prior to the Mahdist revolt in 1882 but were then abandoned and have not been reopened. Iron is found in the Provinces of Bahr el Ghazal, Mongalla, and Upper Nile and has been smelted by the natives in these districts for many years. The most important salt deposits are found in the Selima oasis and the lagoons on the Red Sea coast. Large deposits of gypsum are found in the vicinity of the Red Sea; a lead deposit which is worked to a small extent is reported in Darfur; and soda is found in Dongola.

The production of gold and salt for the years under review is as follows:

Production of gold and salt in the Anglo-Egyptian Sudan, 1924–1929

Mineral	1924	1925	1926	1927	1928	1929
Gold [1] ... grams	310, 848	272, 000	229, 544	221, 643	181, 800	78, 225
Salt ... metric tons	[2] 9, 100	[2] 9, 100	9, 342	9, 872	12, 481	14, 951

[1] Exports of bullion.
[2] Approximate output.

ARABIA [8]

Arabia has virtually no mineral industry. Deposits of bitumen, coal, copper, gold, iron, lead, mica, potash, salt, soda, and sulphur are known, but evidently they are not large enough or rich enough to encourage efforts to overcome the serious handicaps to exploitation. Copper, iron, and lead are found on the coast of the Red Sea between Mecca and Medina. Salt occurs abundantly in the desert interior; and the salt plants of Salif, developed by Italian capital, are said to have some economic importance for India. Silver is mined in small quantities in the interior, and a small output of placer gold is washed by the natives in several places. Bitumen is reported from northern Arabia. Petroleum has long been known to occur in Arabia, especially in the Farsan Islands and on the west coast of the Persian Gulf in Oman.

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[7] Information furnished by W. M. Cramp, American vice consul, Cairo, Egypt; publications of the Imp Inst., London.

[8] Internationale Zeitschrift für Bohrtechnik, Erdölbergbau und Geologie, Die Bodenschätze Arabiens: Jahrg. 36, No. 10, 1928, p. 91; information supplied by A. E. Southard, American consul, Aden, 1920.

ARGENTINA

Mineral production of Argentina, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony ore [2]..........kilograms..	498, 500	([3])	230	....	....	....
Asbestos..........do....	....	....	38, 300	522	....	....
Bismuth ore..........do....	11, 270	....	....	4, 105	21, 180	7, 380
Boronatrocalcite..........tons..	2, 807	3, 656	2, 372	551	563	935
Clay:						
Kaolin..........kilograms..	46, 890	160	3, 140	30, 000	....	....
Other clay..........tons..	....	....	....	10	148	91
Coal [4]..........do....	([4])	([4])	([4])	([4])	([4])	([4])
Copper ore [5]..........do....	451	341	361	268	....	148
Copper-lead ore..........do....	....	58	....	....	....	....
Feldspar..........do....	....	....	....	185	410	427
Fluorspar..........do....	....	....	....	24	....	....
Gold, fine [6]..........kilograms..	90	83	75	30	30	31
Graphite..........tons..	....	....	....	2	....	....
Gypsum..........do....	32, 014	42, 775	36, 121	52, 111	41, 606	36, 630
Iron ore (iron oxide)..........kilograms..	400	....	....	....	....	40
Lead:						
Ore..........tons..	16, 046	3, 961	8, 371	6, 171	2, 924	4, 513
Refined lead [7]..........do....	4, 536	7, 700	8, 200	7, 800	8, 291	9, 020
Lime..........do....	180, 058	209, 077	215, 804	317, 886	366, 779	397, 839
Manganese ore..........do....	....	....	140	230	141	208
Mica..........kilograms..	[8] 4, 510	152, 340	99, 160	105, 918	120, 214	118, 940
Petroleum [9]..........tons..	676, 611	874, 314	1, 143, 232	1, 263, 691	1, 323, 125	1, 301, 393
Salt..........do....	122, 432	75, 351	96, 655	153, 213	167, 617	197, 799
Sand..........do....	36, 802	40, 569	32, 128	75, 457	103, 787	128, 684
Silica (quartz)..........do....	2, 236	4, 349	5, 546	5, 380	7, 163	4, 777
Silver ore..........do....	25	14	6	....	....	....
Silver, fine [6]..........kilograms..	622	560	467	466	467	467
Sodium sulphate..........tons..	863	765	668	652	548	993
Stone:						
Granite..........do....	....	18, 297	47, 978	677, 471	1, 034, 255	1, 133, 003
Limestone..........do....	118, 929	142, 906	175, 540	190, 713	176, 363	193, 994
Marble..........do....	....	....	....	([10])	7	....
Onyx..........do....	....	....	....	536	1, 246	1, 548
Other stone..........do....	882, 866	629, 287	558, 256	126, 960	75, 139	99, 399
Sulphur..........kilograms..	....	....	....	5, 310	500	860
Talc..........do....	....	....	....	....	440	....
Tin ore [2]..........do....	....	1, 070	4, 900	16, 740	36, 710	3, 720
Tungsten ore: Wolfram..........do....	([11])	([11])	([11])	9, 153	22, 875	58, 890
Vanadium ore..........do....	....	....	....	211	....	....
Zinc ore..........tons..	353, 000	....	....	....	....	....

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[1] Source of data. Estadística Minera de la Nación, Dirección Gen. de Minas, Geol. é Hidrol., Buenos Aires (annual), except as otherwise noted. Figures represent shipments by rail or river, except as otherwise noted.

[2] It is probable that a considerable part of the ore shipped is of Bolivian origin and therefore duplicates in part the figures shown under Bolivia.

[3] No rail or river shipments reported. Exports to the amount of 40 tons reported.

[4] No shipments reported. Annual production, including lignite, estimated to be approximately 5,000 tons.

[5] The annual mine production of copper, 1924–1926, inclusive, is estimated in terms of metal at approximately 800 tons. (Imp. Inst., London.)

[6] Production. Figures as published by the Director, U. S. Mint.

[7] Production. Information furnished by American company operating in Argentina.

[8] Exports reported as 120,063 kilograms.

[9] Production (Estadística de Petroleo de la República Argentina, Buenos Aires, annual).

[10] Less than a ton (270 kilos).

[11] No shipments by rail or river reported. Exports reported as follows. 1924, 121,619 kilos; 1925, 4,130 kilos; 1926, 10,000 kilos.

AUSTRALIA

Mineral production of the Commonwealth of Australia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Diatomite..........tons..	573	712	926	1, 229	1, 381	1, 125
Emery..........do....	....	....	52	....	....	....
Flint pebbles..........do....	396	103	118	80	3	13
Alunite..........do....	1, 024	540	589	6	....	39
Amblygonite..........do....	46	....	....	....	....	....

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[1] Compiled from the annual reports of the Mines Departments of the respective Australian States, except as otherwise noted. The lack of uniformity in the methods of reporting mineral statistics in the several States renders the task of combining the figures somewhat difficult and in some cases practically impossible.

Mineral production of the Commonwealth of Australia, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Antimony:						
Ore and concentrates ...tons	280	152	101	133	209	83
Metal (star antimony) ...do	------	------	------	64	48	25
Arsenic:						
Ore and concentrates ...do	[2] 4, 556	4, 635	2, 624	826	5, 924	2, 814
White arsenic...do	1, 338	[3] 301	[3] 202	([4])	[3] 50	[3] 255
Asbestos...do	79	51	112	11	12	260
Barite...do	2, 080	2, 247	1, 973	2, 119	2, 424	2, 167
Bauxite...do	------	------	------	936	196	555
Bismuth ore and concentrates [5]...do	15	12	8	1	7	([4])
Cadmium...kilograms	161, 885	181, 736	162, 799	157, 293	174, 810	202, 260
Calcite...tons	------	25	61	711	564	------
Cement...do	298, 034	342, 067	361, 238	471, 953	602, 322	646, 251
Chromite, crude...do	785	978	607	------	------	131
Clay:						
Fire clay [6]...do	14, 738	38, 653	45, 606	61, 847	53, 550	57, 163
Kaolin...do	4, 906	5, 972	8, 231	14, 166	11, 221	6, 180
Other clays [7]...do	102, 925	1, 858, 840	2, 237, 571	2, 369, 794	2, 373, 874	2, 087, 514
Coal:						
Bituminous...do	13, 978, 308	13, 845, 487	13, 488, 067	13, 740, 003	12, 029, 808	10, 531, 681
Lignite...do	129, 536	890, 535	973, 310	1, 478, 842	1, 617, 407	1, 769, 122
Cobalt:						
Ore and concentrates ...do	200	418	137	------	40	([4])
Metal [8]...kilograms	([9])	91, 445	27, 433	------	7, 925	20, 321
Cobaltiferous manganese ore ...tons	------	------	------	------	------	5
Coke, metallurgical [10]...do	580, 650	624, 669	613, 545	724, 990	532, 673	475, 957
Copper:						
Mine production [11] ...kilograms	14, 806, 897	12, 006, 663	8, 861, 988	10, 133, 067	9, 617, 929	13, 017, 633
Smelter production [11] [12] ...kilograms	14, 326, 305	11, 160, 293	11, 326, 925	9, 717, 502	12, 048, 321	11, 048, 528
Feldspar [13]...tons	15	43	124	109	164	79
Fluorspar...do	2, 372	4, 295	2, 348	1, 050	1, 143	698
Fuller's earth...do	51	33	------	------	------	------
Gems:						
Diamonds...carats	284	210	64	199	28	119
Opals [14]...	($64, 543)	($97, 062)	($108, 898)	($111, 365)	($112, 604)	($86, 098)
Other gem stones [14]...	($130, 826)	($204, 482)	($44, 778)	($25, 461)	($38, 439)	($26, 898)
Gold, fine...grams	21, 009, 096	17, 392, 347	16, 215, 146	15, 811, 597	14, 235, 623	13, 283, 457
Graphite...tons	3	------	------	10	------	51
Gravel...do	[15] 20, 339	178, 839	925, 630	1, 414, 727	2, 231, 273	2, 516, 809
Gypsum...do	87, 239	91, 597	81, 858	124, 813	120, 775	126, 514
Iron:						
Ore [16]...do	732, 474	754, 154	757, 385	917, 534	713, 798	([4])
Pig iron [17]...do	422, 728	446, 472	445, 739	525, 525	417, 468	337, 975
Iron oxide...do	4, 941	4, 446	3, 303	5. 091	4, 733	4, 829
Lead:						
Mine production [11] ...kilograms	156, 607, 851	187, 568, 926	185, 278, 750	203, 386, 793	182, 212, 311	197, 119, 796
Smelter production [11] ...kilograms	130, 494, 350	151, 269, 524	155, 397, 735	167, 615, 736	157, 564, 970	180, 358, 019

[2] Exclusive of the output of Queensland, for which data are not available.

[3] Exclusive of the output of Victoria, for which data are not available.

[4] Data not available.

[5] Exclusive of bismuth-wolfram concentrates, which are included under wolfram.

[6] Some pottery clay from South Australia is included under fire clay, as the products are not reported separately for that State.

[7] Includes some shale.

[8] Estimated content of ore and concentrates.

[9] Content not reported; estimated by F. L. Hess at 60 tons.

[10] Gas-house coke is produced in the Commonwealth; but in view of the varying periods of time covered by the data reported for the several States, it is not practicable to combine the figures in a total for the Commonwealth.

[11] Figures of the Australian Mines and Metals Association, Melbourne.

[12] Figures relate to electrolytic and fire-refined copper.

[13] Includes china stone.

[14] Quantity not reported. Values converted from pounds sterling at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[15] Output from New South Wales only.

[16] Exclusive of iron oxide, which is shown separately.

[17] Figures of Australian Mines and Metals Association. The association's figures for 1928 and 1929 are not available, but the output is estimated by other commercial sources at 417,468 tons and 337,975 tons, respectively.

Mineral production of the Commonwealth of Australia, 1924-1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Lime [18] ..... tons	38, 187	38, 832	47, 066	40, 545	68, 004	66, 861
Magnesite ..... do	13, 056	14, 957	10, 754	10, 586	10, 959	9, 261
Manganese ore ..... do	4, 838	1, 183	1, 414	1, 512	170	318
Mica ..... kilograms	3, 112	3, 840	6, 784	6, 932	25, 355	26, 964
Mineral paint ores ..... tons	1, 568	680	2, 986	416	478	769
Molybdenite ..... kilograms	57, 153	44, 198	43, 080	1, 016	2, 032	559
Nickel: Mine production ..... kilograms	-----	-----	-----	-----	-----	86, 811
Oil shale ..... tons	2, 253	833	2, 161	3, 201	2, 637	4, 368
Phosphate rock ..... do	735	957	1, 275	893	138	71
Platinum metals:						
Osmiridium ..... grams	11, 353	104, 694	98, 691	19, 689	50, 611	42, 301
Platinum ..... do	20, 093	17, 822	12, 348	7, 029	11, 011	3, 981
Salt [19] ..... tons	111, 693	127, 507	140, 563	125, 062	132, 755	(4)
Sericite schist ..... do	-----	-----	-----	-----	-----	23
Shell grit ..... do	1, 473	1, 585	1, 781	1, 920	2, 124	1, 763
Silica ..... do	32, 468	23, 648	23, 043	13, 364	25, 751	21, 082
Silver:						
Mine production [11] ..... kilograms	284, 198	317, 617	320, 642	361, 024	298, 403	313, 245
Refined silver [11] ..... do	237, 357	266, 666	278, 259	292, 064	250, 484	287, 070
Slate:						
Building slate ..... tons	(4)	3, 343	2, 895	3, 267	2, 566	2, 165
Other slate ..... do	(4)	26, 182	25, 298	[20] 49, 164	[20] 57, 269	[20] 64, 899
Stone:						
Building stone [21]—						
Granite ..... do	[15] 547	81, 611	71, 302	145, 386	167, 536	87, 786
Limestone ..... do	[15] 1, 173	16, 068	22, 193	14, 479	12, 490	15, 798
Marble ..... do	[22] 306	2, 176	1, 825	1, 319	2, 140	(4)
Sandstone ..... do	(4)	294, 918	253, 279	371, 942	353, 823	640, 277
Other building stone ..... tons	(4)	4, 037	15, 434	165, 340	157, 496	89, 238
Dolomite ..... do	25, 000	13, 200	17, 146	22, 163	14, 877	15, 426
Limestone [23] ..... do	917, 836	1, 021, 115	1, 026, 155	1, 210, 142	1, 313, 188	1, 327, 647
Road material, etc.[24] ..... do	(4)	[25] 923, 068	2, 934, 626	3, 494, 517	3, 544, 029	3, 537, 257
Talc and soapstone ..... do	873	1, 069	926	1, 117	1, 348	1, 354
Tantalite ..... kilograms	-----	6, 350	19, 762	15, 601	10, 247	27, 789
Tin:						
Mine production [11] ..... tons	3, 118	3, 064	2, 906	3, 194	2, 936	2, 275
Refined tin [11] ..... do	3, 218	3, 222	3, 239	3, 037	3, 183	1, 569
Tungsten ores and concentrates:						
Scheelite ..... tons	-----	-----	-----	-----	-----	9
Wolfram [26] ..... do	65	189	85	157	206	206
Uranium ore [14]	-----	($831)	-----	($5, 294)	-----	-----
Whiting, natural ..... tons	-----	-----	-----	-----	-----	101
Zinc:						
Mine production [11] ..... kilograms	109, 894, 952	141, 010, 467	153, 297, 560	174, 283, 057	150, 236, 201	157, 042, 720
Smelter production [11] ..... kilograms	47, 116, 271	46, 431, 453	48, 116, 064	49, 943, 938	51, 029, 079	52, 704, 546

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[4] Data not available.

[11] Figures of the Australian Mines and Metals Association, Melbourne

[14] Quantity not reported. Values converted from pounds sterling at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[15] Output from New South Wales only.

[18] Figures for 1924 to 1927, inclusive, output of New South Wales, those for 1928 and 1929 output of New South Wales and Victoria. The other States make no returns for lime.

[19] Partly estimated.

[20] Includes some clay and shale.

[21] Exclusive of slate, which is shown separately.

[22] Output from New South Wales and Queensland only.

[23] Exclusive of that reported under "Building stone."

[24] Exclusive of gravel and slate, which are shown separately.

[25] Returns for South Australia only. A production of 642,439 cubic meters reported for New South Wales, weight not stated.

[26] Includes some bismuth-wolfram concentrates.

Mineral production of the Commonwealth of Australia, 1924–1929, by States

State and mineral	1924	1925	1926	1927	1928	1929
CENTRAL AUSTRALIA [1]						
Lead ore (silver-lead) ... tons	----------	----------	----------	----------	----------	80
Mica ... kilograms	(2)	(2)	(2)	1,852	23,323	24,170
Tungsten ore: Wolfram ... tons	----------	----------	----------	----------	----------	17
NEW SOUTH WALES [3]						
Abrasives:						
Diatomite ... tons	573	712	926	122	1,381	1,125
Emery ... do	----------	----------	52	----------	----------	----------
Alunite [4] ... do	1,024	540	589	----------	----------	----------
Antimony:						
Ore and concentrates ... tons	----------	29	86	128	203	81
Metal (star antimony) ... tons	----------	----------	----------	64	48	25
Arsenic:						
Ore and concentrates ... tons	4,487	3,400	[5] 1,796	755	5,924	2,814
White arsenic ... do	328	301	202	(6)	50	255
Asbestos ... do	----------	----------	5	----------	----------	----------
Barite ... do	152	203	203	203	20	154
Bismuth ore and concentrates ... tons	15	11	8	1	7	(6)
Calcite ... do	----------	25	61	711	564	----------
Cement, Portland ... do	276,670	308,970	327,088	432,642	415,507	440,930
Chromite, crude ... do	785	978	607	----------	----------	131
Clay:						
Fire clay ... do	9,106	17,942	18,716	35,048	28,150	35,198
Kaolin ... do	3,137	3,854	4,824	11,501	9,397	4,293
Other clay ... do	102,925	1,526,671	1,836,100	1,986,509	2,149,597	1,935,936
Coal ... do	11,804,688	11,579,108	11,060,483	11,304,688	9,599,841	7,740,000
Cobaltiferous manganese ore ... tons	----------	----------	----------	----------	----------	5
Coke:						
Metallurgical ... do	573,420	619,199	607,255	720,727	528,550	471,813
Gas-house [7] ... do	391,316	410,096	418,399	418,239	436,550	442,811
Copper:						
Ore and concentrates ... tons	8,037	4,519	4,871	2,585	305	2,481
Metal [8] ... kilograms	1,141,120	485,612	362,730	210,322	55,883	178,825
Feldspar ... tons	15	33	11	[9] 16	[9] 49	[9] 58
Fluorspar ... do	478	----------	----------	----------	----------	96
Fuller's earth ... do	51	33	----------	----------	----------	----------
Gems:						
Diamonds ... carats	284	210	64	199	28	119
Opals [10] ...	($45,791)	($48,434)	($55,797)	($64,909)	($53,528)	($29,486)
Other gem stones [11] ... grams	84,384	46,344	56,235	96,981	53,094	2,022
Gold, fine ... do	581,169	604,092	604,496	560,858	399,089	233,152
Graphite ... tons	----------	----------	----------	10	----------	51
Gravel ... do	20,339	[12] 122,264	[12] 830,941	[12] 1,289,225	[12] 2,122,872	[12] 2,410,464
Gypsum ... do	2,709	301	830	1,506	12,761	10,585
Iron:						
Ore [13] ... do	142,852	157,735	159,788	182,999	85,558	(6)
Pig iron [14] ... do	75,264	95,530	106,889	120,860	57,687	3,974
Iron oxide ... do	4,941	4,446	3,303	5,091	4,733	4,829

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[1] Information furnished by the Government Resident, Central Australia.

[2] See under Northern Territory. The Northern Territory was divided Mar. 1, 1927, into the 2 States of Central Australia and North Australia.

[3] Source of data: Ann. Rept., Dept. Mines, New South Wales, except as otherwise noted.

[4] K_2O content, as reported by Imp. Inst., London, as follows: 1924, 89 tons; 1925, 45 tons; 1926, 51 tons.

[5] Exclusive of output of Ottery mine, for which data are not available.

[6] Data not available.

[7] Year ended June 30, of year stated (Imp. Inst., London).

[8] Figures of the Australian Mines and Metals Association, representing estimated copper content of ores mined in the State.

[9] Includes china stone.

[10] Quantity not reported. (See footnote 14 under the Commonwealth.)

[11] Values, converted from pounds sterling at the annual average rate of exchange, reported as follows: 1924, $24,679; 1925, $37,531; 1926, $11,747; 1927, $12,711; 1928, $13,913; 1929, $2,186.

[12] Reported in cubic yards, which have been converted to tons on the basis of 1.36077 tons to the cubic yard.

[13] Exclusive of iron oxide, which is shown separately.

[14] Made from ores mined in the State.

Mineral production of the Commonwealth of Australia, 1924–1929, by States—Con.

State and mineral	1924	1925	1926	1927	1928	1929
NEW SOUTH WALES—contd.						
Lead ore (silver-lead)[15] tons	1,067,537	1,286,296	1,317,563	1,417,315	1,177,054	1,248,917
Lime do	38,187	38,832	47,066	40,545	45,325	41,708
Magnesite, crude do	12,697	14,237	10,428	10,178	10,840	9,097
Manganese ore do	4,457	1,183	1,311	1,221	170	237
Mica kilograms	----	(6)	----	----	----	2,794
Mineral paint ores (ocher, umber, etc.) tons	750	280	534	279	422	710
Molybdenite do	11	[illegible]	(16)	----	2	(16)
Oil shale do	652	----	----	----	----	----
Phosphate rock do	109	203	257	132	138	71
Platinum grams	20,093	17,822	12,348	7,029	11,011	3,981
Shell grit tons	1,473	1,585	1,781	1,920	2,124	1,763
Silica do	32,468	23,457	22,587	12,907	25,670	21,031
Silver, fine kilograms	2,908	1,478	291	166	267	139
Slate:						
Building slate tons	(17)	203	157	339	299	111
Other slate do	----	----	183	1,422	6,249	----
Stone:						
Building stone[18]—						
Basalt do	----	----	13,640	85,786	109,451	58,627
Granite do	547	81,492	71,038	145,284	167,536	86,716
Limestone[19] do	1,173	1,534	2,326	2,524	3,846	2,670
Marble do	219	493	613	590	557	558
Sandstone do	(6)	275,914	224,681	349,337	336,305	626,271
Syenite do	(6)	1,570	1,794	2,554	5,222	5,730
Miscellaneous do	(6)	2,467	----	77,000	42,823	24,881
Dolomite do	25,000	13,200	17,146	22,163	14,877	15,426
Limestone (for cement, flux, lime, etc.) tons	559,844	643,961	634,166	790,014	728,206	770,387
Road material[20] do	(6)	(6)	1,738,463	2,222,898	2,373,084	2,396,551
Talc and soapstone do	543	711	366	488	674	555
Tin, ingots do	1,058	972	1,152	992	1,036	949
Tungsten ores:						
Scheelite do	----	----	----	----	----	9
Wolfram do	9	7	----	----	----	14
Zinc concentrates do	359,326	230,161	271,827	281,878	319,918	234,948
NORTH AUSTRALIA[21]						
Copper ore tons	(2)	(2)	(2)	----	----	67
Gold, fine grams	(2)	(2)	(2)	5,423	3,652	1,368
Lead ore (silver-lead) tons	(2)	(2)	(2)	8	----	25
Tantalite kilograms	----	----	----	76	1,346	3,404
Tin concentrates tons	(2)	(2)	(2)	101	73	54
NORTHERN TERRITORY[22]						
Amblygonite tons	46	----	----	----	----	----
Copper[8] kilograms	9,144	1,016	----	(23)	(23)	(23)
Gold, fine grams	6,967	13,836	4,760	(23)	(23)	(23)
Graphite tons	3	----	----	----	----	----
Lead ore (silver-lead) do	[24] 194	53	26	(23)	(23)	(23)
Mica kilograms	3,112	3,332	2,720	(25)	(25)	(25)
Tin concentrates tons	91	118	92	(23)	(23)	(23)

[2] See under Northern Territory. The Northern Territory was divided Mar. 1, 1927, into the 2 States of Central Australia and North Australia.

[6] Data not available.

[8] Figures of the Australian Mines and Metals Association, representing estimated copper content of ores mined in the State.

[15] Output of Broken Hill division. The estimated metal content of all silver-lead ores mined in New South Wales, treated within the Commonwealth of Australia or exported is as follows: 1924—cadmium, 152,153 kilos; copper, 634 tons; lead, 144,170 tons; silver, 287,915 kilos; zinc, 160,488 tons; 1925—antimony, 22 tons; cadmium, 159,012 kilos; copper, 131 tons; lead, 173,329 tons; silver, 286,779 kilos; zinc, 117,279 tons; 1926—antimony, 1 ton; arsenic, 6 tons; cadmium, 135,389 kilos; copper, 735 tons; gold, 1,369 grams; lead, 168,559 tons; silver, 302,007 kilos; zinc, 137,618 tons; 1927—cadmium, 136,791 kilos; lead, 185,952 tons; silver, 318,538 kilos; zinc, 160,414 tons; 1928—cadmium, 154,765 kilos; lead, 165,461 tons; silver, 259,058 kilos; zinc, 141,222 tons; 1929—cadmium, 184,484 kilos; lead, 175,140 tons; silver, 262,998 kilos; zinc, 124,753 tons. In 1927, 1928, and 1929 antimony, copper, and gold are also reported contained in the ores, but quantities are not stated.

[16] Less than 1 ton reported; in 1926, 406 kilos; in 1929, 559 kilos.

[17] Output of 53,434 roofing slates reported; weight not stated.

[18] Exclusive of slate, which is shown separately.

[19] Used principally for terrazzo work.

[20] Exclusive of slate and gravel, which are shown separately.

[21] Information furnished by the Director of Mines and Chief Warden, North Australia.

[22] Information furnished by the Director of Mines, Northern Territory.

[23] See under North Australia.

[24] Reported to contain zinc also in payable quantities.

[25] See under Central Australia.

Mineral production of the Commonwealth of Australia, 1924–1929, by States—Con.

State and mineral	1924	1925	1926	1927	1928	1929
QUEENSLAND [26]						
Alunite..........tons	----------	----------	----------	6	----------	----------
Antimony ore..........do	----------	----------	10	5	4	----------
Arsenic:						
Ore..........do	(6)	1, 133	828	71	----------	----------
White arsenic..........do	573	----------	----------	----------	----------	----------
Bismuth concentrates [27] ....kilograms	254	508	----------	(27)	864	102
Clay, fire..........tons	5, 189	2, 932	340	----------	----------	----------
Coal..........do	1, 141, 143	1, 196, 067	1, 240, 657	1, 116, 680	1, 093, 615	1, 390, 713
Cobalt:						
Ore and concentrates ....do	200	418	137	----------	40	(6)
Metal [28]..........kilograms	(29)	91, 445	27, 433	----------	7, 925	20, 321
Coke:						
Metallurgical..........tons	7, 230	5, 470	6, 290	4, 263	4, 123	4, 144
Gas-house [7]..........do	(6)	56, 092	58, 411	58, 981	58, 166	55, 164
Copper [8]..........kilograms	5, 826, 032	4, 053, 023	1, 236, 534	3, 801, 043	2, 830, 715	3, 482, 003
Fluorspar..........tons	1, 894	4, 295	2, 348	1, 050	1, 143	602
Gems:						
Opal [10]..........	($1, 308)	($4, 829)	($2, 915)	($1, 944)	($2, 920)	($2, 914)
Other gem stones [10]..........	($106, 147)	($166, 951)	($33, 031)	($10, 704)	($20, 098)	($23, 362)
Gold, fine..........grams	3, 074, 299	1, 443, 388	321, 579	1, 181, 279	412, 961	294, 737
Ironstone for flux..........tons	----------	351	4, 483	515	----------	1, 256
Lead [28]..........do	3, 754	5, 319	3, 795	929	44	395
Magnesite, crude..........do	151	271	----------	----------	----------	----------
Manganese ore..........do	----------	----------	20	246	----------	----------
Mica..........kilograms	----------	508	----------	1, 016	----------	----------
Molybdenite..........tons	3	3	----------	1	----------	----------
Silica..........do	----------	171	395	----------	----------	----------
Silver, fine..........kilograms	8, 605	11, 990	7, 855	2, 616	685	1, 638
Stone:						
Limestone..........tons	98, 454	83, 896	73, 588	86, 325	73, 939	68, 298
Marble..........do	87	23	9	105	122	[10] ($3, 094)
Tin concentrates..........do	1, 215	1, 028	1, 075	1, 130	1, 031	1, 004
Tungsten ore: Wolfram [27] ....tons	1	5	(30)	6	27	20
Zinc [28]..........do	130	173	[31] 203	----------	----------	----------
SOUTH AUSTRALIA [32]						
Abrasives: Flint pebbles ....tons	396	103	118	80	3	13
Arsenic ore..........do	69	102	----------	----------	----------	----------
Asbestos..........do	4	----------	----------	----------	----------	1
Barite..........do	1, 928	2, 040	1, 770	1, 916	2, 404	2, 001
Clay:						
Fire and pottery clay ....tons	443	17, 779	26, 550	26, 799	25, 021	21, 965
Kaolin..........do	----------	498	203	152	163	142
Other clays [33]..........do	(6)	332, 169	401, 471	383, 249	224, 277	151, 578
Coke, gas-house [7]..........do	55, 549	53, 420	59, 062	65, 693	64, 803	64, 114
Copper [8]..........kilograms	411, 500	579, 149	235, 724	215, 403	195, 082	281, 446
Feldspar [9]..........tons	----------	10	105	93	115	----------
Gems: Opals [10]..........	($17, 444)	($43, 799)	($50, 186)	($44, 512)	($56, 156)	($53, 698)
Gold, fine..........grams	27. 371	25, 878	23, 576	13, 001	16, 547	31, 383
Gravel..........tons	(6)	56, 575	94, 689	125, 502	108, 401	106, 345
Gypsum..........do	66, 744	73, 436	66, 666	95, 356	93, 004	97, 148
Iron ore..........do	589, 622	596, 068	593, 114	734, 020	628, 240	861, 420
Lead ore (silver-lead)..........do	7	38	28	5	----------	6
Magnesite, crude..........do	131	357	230	335	46	137
Manganese ore..........do	321	----------	----------	----------	----------	----------
Mica..........kilograms	----------	----------	----------	----------	2, 032	----------
Mineral paint ores: Ocher ....tons	721	88	37	21	56	59
Phosphate rock..........do	85	754	896	761	----------	----------
Salt..........do	63, 693	79, 507	92, 563	80, 559	72, 574	77, 684
Silica..........do	----------	20	61	457	81	51
Silver..........kilograms	32	45	11	6	----------	38

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[6] Data not available.

[7] Year ended June 30, of year stated (Imp. Inst., London).

[8] Figures of the Australian Mines and Metals Association, representing estimated copper content of ores mined in the State.

[9] Includes china stone.

[10] Quantity not reported. (See footnote 14 under the Commonwealth.)

[26] Source of data: Ann. Rept., Under Secretary for Mines, Queensland, except as otherwise noted.

[27] Bismuth-wolfram ore and concentrates included under wolfram.

[28] Estimated content of ores and concentrates.

[29] Content not reported, estimated by F. L. Hess at 60 tons.

[30] Less than 1 ton (508 kilos).

[31] Exports.

[32] Source of data: Mining Review, Dept. Mines, South Australia (annual), except as otherwise noted.

[33] Includes some shale.

Mineral production of the Commonwealth of Australia, 1924–1929, by States—Con.

State and mineral	1924	1925	1926	1927	1928	1929
SOUTH AUSTRALIA—contd.						
Slate:						
Building slate ____ tons	(⁶)	3,140	2,738	2,928	2,207	2,054
Other slate ____ do	(⁶)	26,182	25,115	[22] 47,742	[22] 51,020	[22] 64,899
Stone:						
Building stone—						
Granite ____ do	(⁶)	119	264	102		1,070
Limestone ____ do	(⁶)	14,534	19,867	11,955	8,644	13,128
Marble ____ do	(⁶)	1,660	1,203	624	1,361	891
Sandstone ____ do	(⁶)	19,004	28,598	22,605	17,518	14,006
Limestone—						
For cement, flux, and agriculture ____ tons	111,052	116,714	121,635	123,218	82,268	82,354
For lime ____ do	(⁶)	49,873	40,592	38,342	34,629	18,723
Road materials, ballast, etc.[20] ____ tons	(⁶)	923,068	1,196,163	1,271,619	1,170,945	1,140,706
Talc and soapstone ____ do	330	358	560	629	641	776
Uranium ore [19] ____ do		($831)		($5,294)		
Whiting, natural ____ do						101
TASMANIA [23]						
Barite ____ tons		4				10
Cadmium:						
From Tasmanian ores ____ kilograms	5,431	5,230	10,568	19,581	20,043	17,779
From other ores ____ do	156,554	176,406	152,231	137,712	154,809	184,481
Cement ____ tons	21,304	33,097	34,150	39,311	45,518	42,409
Coal ____ do	77,208	83,609	104,000	113,854	130,562	132,382
Coke, gas-house [24] ____ do	[7] 11,525	11,078	6,206	6,341	5,644	5,643
Copper [8] ____ kilograms	6,805,503	6,643,951	7,025,986	5,904,267	6,524,656	9,011,348
Gold, fine ____ grams	143,885	109,605	131,342	151,185	112,079	174,086
Lead [21] ____ tons	4,632	5,615	5,988	5,673	4,864	6,079
Mineral paint ores: Ocher ____ tons	20		39			
Nickel, metallic (mine production) ____ tons						87
Oil shale ____ do	1,601	833	2,161	3,201	2,637	4,368
Platinum metals: Osmiridium ____ grams	11,353	104,694	98,691	19,689	50,611	42,301
Sericite schist ____ tons						23
Silver, fine ____ kilograms	19,973	22,712	23,846	23,072	20,818	26,884
Stone: Limestone ____ tons	148,486	126,671	156,174	172,243	100,237	69,270
Talc ____ do					33	23
Tin, metallic ____ do	1,126	1,148	1,114	1,124	1,158	650
Tungsten ores: Wolfram ____ tons	55	177	84	151	179	154
Zinc [25] ____ kilograms	47,116,271	46,431,453	48,116,064	49,943,938	51,029,079	52,704,546
VICTORIA [26]						
Antimony concentrates [27] tons	280	123			2	2
Arsenic, white ____ do	[28] 437	(⁶)	(⁶)	(⁶)	(⁶)	(⁶)
Bauxite ____ do				936	196	555
Cement ____ do	(⁶)	(⁶)	(⁶)	(⁶)	141,297	162,852
Clay: Kaolin ____ do	1,769	1,620	3,204	2,513	1,661	1,745
Coal:						
Bituminous ____ do	526,634	542,821	600,487	695,227	668,889	715,124
Lignite ____ do	129,536	890,535	973,310	1,478,842	1,617,407	1,769,122
Coke, gas-house [7] ____ do	263,238	270,712	278,167	288,556	295,749	284,379
Copper ore ____ do						10
Gold, fine ____ grams	2,089,128	1,471,070	1,526,497	1,198,666	1,054,937	817,244
Gypsum ____ tons	13,481	14,751	10,381	21,169	10,728	13,407
Lead ore (silver lead) ____ do				6	5	
Lime ____ do	(⁶)	(⁶)	(⁶)	(⁶)	22,679	25,153
Magnesite, crude ____ do	77	92	96	73	73	27
Manganese ore ____ do				15		

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[6] Data not available.

[7] Year ended June 30, of year stated (Imp. Inst., London).

[8] Figures of the Australian Mines and Metals Association, representing estimated copper content of ores mined in the State.

[19] Quantity not reported. (See footnote 14 under the Commonwealth.)

[20] Exclusive of slate and gravel, which are shown separately.

[21] Estimated content of ores and concentrates.

[22] Includes some shale.

[23] Source of data: Ann. Rept., Director of Mines, Tasmania, except as otherwise noted.

[24] Figures as published by Imp. Inst., London. With exception of 1924, data relate to calendar years.

[25] Figures of Australian Mines and Metals Association, representing total production of zinc smelted in Tasmania from Tasmanian and other ores.

[26] Source of data: Gold and Mineral Statistics, Dept. Mines, Victoria (annual), except as otherwise noted.

[27] Average antimony content reported as follows: 1924, 58 per cent; 1925, 55 per cent; 1928 and 1929, content not stated.

[28] Data furnished by U. S. Trade Commissioner, Melbourne, Feb. 21, 1925.

Mineral production of the Commonwealth of Australia, 1924–1929, by States—Con.

State and mineral	1924	1925	1926	1927	1928	1929
VICTORIA—continued						
Mineral paint ores: Ocher, etc.......tons..	77	312	[40] 2,376	[40] 116	----------	----------
Molybdenite.......do....	43	35	43	----------	----------	----------
Phosphate rock.......do....	541	----------	122	----------	----------	----------
Salt [41].......do....	[42] 40,000	[42] 40,000	[42] 40,000	36,503	52,181	(6)
Silver, fine [43].......kilograms..	131	65	74	46	45	28
Stone: Limestone.......tons..	(6)	(6)	(6)	(6)	293,909	318,735
Tin concentrates.......do..	39	70	29	64	87	25
WESTERN AUSTRALIA [44]						
Alunite.......tons..	----------	----------	----------	----------	----------	[45] [46] 39
Antimony concentrates.......do..	----------	----------	5	----------	----------	----------
Asbestos [45].......do....	75	51	107	11	12	259
Barite.......do..	----------	----------	----------	----------	----------	2
Clay:						
Fire clay.......do..	----------	----------	----------	----------	379	----------
Other clay.......kilograms..	----------	----------	----------	35,562	----------	102
Coal [45].......tons..	428,635	444,482	482,440	509,554	536,901	553,462
Coke, gas-house [41] [45].......do....	6,789	(47)	[48] 10,646	[7] 8,309	[7] 9,849	[7] 11,579
Copper:						
Ore [45].......do..	10,928	2,510	(6)	(6)	46	131
Metal [8].......kilograms..	607,598	243,852	1,016	2,032	12,192	35,562
Feldspar.......tons..	----------	----------	8	----------	----------	21
Gems: Emeralds.......carats..	----------	----------	----------	[49] 200	[49] 17,564	(6) (49)
Gold, fine [50].......grams..	15,086,277	13,724,478	13,602,896	12,701,185	12,236,358	11,731,487
Gypsum [45].......tons..	4,305	3,109	3,981	6,782	4,282	5,374
Lead:						
Ore [45].......do....	37,340	38,556	24,450	6,000	132	451
Metal [28].......do....	3,076	[51] 3,459	[51] 2,465	[51] 771	[51] 21	(6)
Manganese ore.......do....	[45] 60	----------	83	30	----------	81
Mica.......kilograms..	----------	----------	4,064	4,064	----------	----------
Salt [41] [42].......tons..	8,000	8,000	8,000	8,000	8,000	8,000
Silver, fine.......kilograms..	2,773	2,526	2,128	1,552	1,728	1,550
Tantalite [45].......do....	----------	6,350	19,762	15,525	8,901	24,385
Tin concentrates.......tons..	88	110	[45] 99	[45] 98	[45] 91	[45] 78

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[6] Data not available.

[8] Figures of the Australian Mines and Metals Association, representing estimated copper content of ores mined in the State.

[28] Estimated content of ores and concentrates.

[40] Includes red oxide from jarosite.

[41] Figures as published by Imp. Inst., London.

[42] Approximate production.

[43] Extracted from gold at the Melbourne Mint.

[44] Source of data: Rept., Dept. Mines, Western Australia (annual), except as otherwise noted. Data relate to exports, except as otherwise noted.

[45] Production.

[46] K_2O content reported as 3 tons (Imp. Inst., London).

[47] See under 1926.

[48] Figures represent output for 18 months ended June 30, 1926.

[49] Figures relate to cut stones in 1927, uncut stones in 1928, and cut and rough stones in 1929. Values, converted from pounds sterling at the annual average rate of exchange, reported as follows: 1927, $2,046; 1928, $4,428; 1929, $1,350.

[50] Exported and minted.

[51] Exclusive of the following quantities of silver-lead ore, for which the content is not reported: 1925, 82 tons; 1926, 92 tons; 1927, 98 tons; 1928, 18 tons; 1929, no silver-lead ore reported.

AUSTRIA

Mineral production of Austria, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony:						
Ore [2] ... tons	8	-----	1, 088	12, 595	16, 049	11, 291
Metal (regulus) ... do	-----	-----	30	127	16	-----
Arsenic ore [3] ... do	560	89	-----	-----	-----	-----
Barite ... do	1, 399	1, 363	966	1, 924	2, 243	300
Briquets ... do	-----	-----	-----	-----	-----	420
Coal:						
Bituminous ... do	171, 959	145, 200	157, 308	175, 601	202, 098	208, 020
Lignite ... do	2, 785, 816	3, 033, 378	2, 957, 728	3, 064, 068	3, 262, 570	3, 524, 792
Coke, gas-house ... do	450, 590	476, 914	476, 465	530, 263	575, 773	628, 948
Copper:						
Ore [4] ... do	84, 598	87, 687	114, 507	131, 050	134, 115	135, 114
Metal (smelter product) ... kilograms	3, 848, 000	3, 779, 000	3, 203, 000	3, 308, 000	3, 423, 500	3, 895, 300
Gold ores [5] ... tons	5, 627	7, 931	5, 642	472	-----	-----
Gold, fine [6] ... kilograms	61	58	41	4	10	-----
Graphite ... tons	9, 523	13, 079	14, 756	18, 058	24, 226	25, 296
Gypsum [7] ... do	60, 000	60, 000	58, 000	40, 000	45, 000	43, 000
Iron:						
Ore [8] ... do	713, 805	1, 030, 364	1, 094, 372	1, 598, 570	1, 928, 182	1, 891, 381
Pig iron ... do	266, 463	379, 921	331, 635	432, 749	458, 451	458, 973
Lead (smelter product) ... kilograms	4, 985, 000	5, 408, 000	6, 478, 000	8, 086, 000	8, 135, 100	6, 569, 000
Lead concentrates [9] ... tons	6, 575	7, 087	9, 272	9, 240	8, 569	7, 673
Lead-zinc ores, crude [10] ... do	112, 698	104, 266	124, 288	127, 882	130, 890	115, 025
Magnesite, crude ... do	([11])	290, 000	237, 000	356, 000	310, 000	438, 000
Mercury, metallic ... kilograms	4, 500	5, 850	5, 875	5, 524	4, 580	3, 870
Mineral paint ores ... tons	1, 130	1, 383	1, 249	2, 627	2, 177	1, 604
Nickel:						
Ammonium sulphate [12] ... do	-----	-----	342	167	-----	-----
Carbonate [12] ... do	-----	-----	-----	284	-----	-----
Nickel (smelter product) [12] ... do	-----	-----	-----	-----	-----	44
Oxide [12] ... do	-----	-----	-----	188	196	195
Oil shale, ichthyolic ... do	373	653	473	452	659	670
Pyrites:						
Cupreous-iron [13] ... do	27, 712	24, 900	21, 600	18, 118	10, 000	-----
Iron ... do	334	172	693	1, 210	-----	-----
Salt:						
Rock salt ... do	2, 744	2, 087	3, 227	2, 675	1, 607	3, 041
Brine salt ... do	108, 425	128, 720	141, 914	145, 405	152, 212	175, 442
Silver, fine [6] ... kilograms	892	744	437	301	588	329
Talc (exports) ... tons	9, 587	12, 883	13, 861	17, 135	19, 755	19, 603
Wulfenite (content MoO_3) ... kilograms	65, 400	12, 600	27, 400	50	4, 900	390
Zinc concentrates [14] ... tons	1, 227	1, 892	2, 305	3, 855	4, 726	3, 994

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[1] Source of data: Mitteilungen über den Österr. Bergbau, Bundesmin. f. Handel u. Verkehr, Vienna (annual); Data furnished by Bundesmin. f. Handel u. Verkehr, through American consulate, Vienna; Statistik des auswärt. Handels Oesterreichs, Vienna (annual); and other sources as noted.

[2] Estimated antimony content of ores reported as follows: 1924, 0.8 ton; 1926, not stated; 1927, 1,071 tons; 1928, 1,143 tons; 1929, 700 tons.

[3] Exclusive of arsenical gold ores worked primarily for their gold and silver content, which are included under gold ores. Arsenic content of arsenic ore reported as follows: 1924, 40 tons; 1925, 15 tons.

[4] Estimated copper content reported as follows: 1924, 1,748 tons; 1925, 1,684 tons; 1926, 2,130 tons; 1927, 2,268 tons; 1928, 2,985 tons; 1929, 2,081 tons.

[5] Arsenical ores mined primarily for their gold and silver content. Content of the ores reported as follows: Gold—1924, 67 kilos; 1925, 70 kilos; 1926, 58 kilos; 1927, 5 kilos; silver—1924, 286 kilos; 1925, 273 kilos; 1926, 303 kilos; 1927, 25 kilos; arsenic—1924, 216 tons; 1925, 237 tons; 1926, 155 tons; 1927, 14 tons; lead—1924 14 tons; 1925, 14 tons; 1926, 21 tons; 1927, 1 ton.

[6] Figures of production as published by the Director, U. S. Mint.

[7] Official estimate of approximate production.

[8] Manganese content reported as follows. 1924, 15,007 tons; 1925, 21,387 tons; 1926, 23,286 tons; 1927, 32,957 tons; 1928, 39,563 tons; 1929, 39,053 tons.

[9] Produced from lead-zinc ores. Lead content reported as follows: 1924, 4,507 tons; 1925, 4,758 tons; 1926, 5,939 tons; 1927, 6,188 tons; 1928, 5,952 tons; 1929, 5,516 tons.

[10] Lead and zinc content reported as follows: 1924—lead, 6,467 tons; zinc, 1,205 tons; 1925—lead, 6,461 tons, zinc, 1,908 tons; 1926—lead, 8,176 tons, zinc, 2,248 tons; 1927—lead, 9,346 tons, zinc, 3,502 tons; 1928—lead, 5,964 tons, zinc, 3,156 tons; 1929—lead, 7,507 tons, zinc, 3,960 tons.

[11] Data not available.

[12] Produced in copper smelters

[13] Copper content reported as follows: 1924, 193 tons; 1925, 156 tons; 1926, 108 tons; 1927, 64 tons; 1928, 50 tons; 1929, 1,551, tons.

[14] Zinc content reported as follows: 1924, 488 tons; 1925, 777 tons; 1926, 889 tons; 1927, 1,562 tons; 1928, 1,818 tons; 1929, 1,554 tons.

BASUTOLAND

Mining in Basutoland is virtually nonexistent. Indications of copper and iron have been reported, and coal has been found and used locally,[9] but there have been no developments worthy of note.

BECHUANALAND PROTECTORATE

The Bechuanaland Protectorate [10] has not to date given promise of becoming an important mineral district of South Africa. No geological survey of the country has been made, not even of the Tati district, which so far has proved the most interesting part of the territory as regards minerals. Deposits of coal, copper, gold, iron, and silver are known, but only the precious metals have been exploited commercially.

The production of gold and silver for the period under review appears below; the figures are for the year ended March 31 of the year following that stated:

Mineral production of Bechuanaland Protectorate, 1924–1929, in grams [1]

Metal	1924	1925	1926	1927	1928	1929
Gold, fine	42, 674	114, 212	133, 621	118, 411	64, 166	52, 440
Silver, fine	7, 776	1, 539	14, 214	13, 001	4, 883	4, 603

[1] Figures as published by the Imp. Inst., London, converted to grams.

BELGIAN CONGO

Mineral production of the Belgian Congo, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Coal:						
Anthracite and bituminous tons	81, 480	65, 100	90, 250	86, 950	97, 780	114, 450
Lignite do	-----------	-----------	-----------	-----------	-----------	2, 800
Cobalt alloy do	976	684	794	2, 100	([b])	([b])
Copper:						
Ore do	1, 564, 958	1, 388, 453	1, 406, 082	1, 730, 000	1, 911, 000	2, 225, 000
Metal (smelter product) kilograms	85, 570, 000	90, 104, 000	80, 639, 000	89, 156, 000	[c] 111,510, 000	[c] 135,539, 000
Diamonds carats	550, 347	883, 903	1, 114, 383	1, 032, 544	1, 647, 700	1, 907, 665
Gold, fine [d] kilograms	3, 674	3, 819	4, 112	3, 901	4, 296	5, 376
Iron ore, for flux tons	105, 195	87, 258	113, 511	78, 000	51, 000	50, 000
Limestone, for flux do	178, 729	203, 926	192, 221	202, 000	199, 000	198, 000
Silver, fine [d] kilograms	-----------	-----------	-----------	330	330	373
Tin concentrates tons	1, 402	1, 538	1, 604	1, 231	1, 107	1, 371
Uranium ore [e] do	([f])	([f])	([f])	([f])	268	([f])

[a] Source of data: Annuaire Statistique de la Belgique et du Congo Belge, Brussels; information furnished by Ministère des Colonies, Belgium; Ann. Rept. Tanganyika Concessions (Ltd.); other sources as noted.

[b] Gross weight not available; cobalt content reported as follows: 1928, 450 tons; 1929, 700 tons.

[c] In addition to the crude copper smelted in the Belgian Congo, the following quantities were smelted in Belgium from mattes and alloys produced in the Belgian Congo: 1928, 946,000 kilos; 1929, 1,453,000 kilos.

[d] Figures as published by the Director, U. S. Mint.

[e] Radium produced at Oolen, Belgium, from the Belgian Congo ores reported as follows: 1924, 22 grams; 1925, 20 grams; 1926, 20 grams; 1927, 26 grams; 1928, 42 grams; 1929, 60 grams.

[f] Data not available.

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[9] Statesman's Year Book, London (annual).

[10] Information supplied by the American consulates at Johannesburg and Cape Town, South Africa.

BELGIUM

Mineral production of Belgium, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasive: Whetstones number	140,970	145,250	142,610	179,970	228,890	141,700
Antimony, metallic tons	170	(2)	(2)	(2)	(2)	(2)
Arsenic, white do	1,850	(2)	(2)	(2)	(2)	(2)
Barite do	20,490	13,190	6,100	1,630	740	
Briquets, fuel do	2,030,310	2,237,171	2,142,660	1,688,970	1,959,130	2,018,110
Cement [3] do	141,400	449,900	523,210	499,070	947,370	950,560
Chalk, white cubic meters	733,650	275,909	69,990	93,530	88,120	110,570
Clay:						
Kaolin and eurite tons	17,000	10,730	5,450	11,020	10,660	11,250
Other clay do	787,340	435,635	458,686	429,603	438,304	478,790
Coal do	23,361 910	23,097,040	25,259,600	27,550,960	27,578,500	26,939,930
Coke do	4,308,797	4,236,354	5,076,954	5,879,970	6,322,920	6,192,960
Coke by-products:						
Ammonium sulphate tons	54,500	53,422	65,311	81,790	86,230	85,340
Benzol do	23,590	25,480	30,656	39,650	44.770	42.100
Tar do	132,400	124,041	146,885	179,940	196,280	194,430
Copper:						
Blister copper kilograms	8,100,000	9,730,000	9,497,000	8,860,000	9,720,000	8,940,000
Matte tons	7,970	8,980	9,653	7,210	9,720	(4)
Refined copper do	830	1,410	509	950	41,690	59,280
Copper sulphate do	5.800	6,470	7,743	10.310	11,430	9,920
Gold, fine grams				2,138,000	(5)	(5)
Gravel tons	87,168	66,320	57,504	102,496	52,970	78,192
Iron:						
Ore do	154,970	165,650	144.980	180,890	164,420	155,670
Pig iron [6] do	2.843,920	2,542,507	3.368,547	3,709,090	3,856,990	4,040,530
Lead:						
Work lead kilograms	19,630,000	21,910,000	26,176,000	25,570,000	23,680.000	22,860,000
Refined lead tons	58,320	65,570	61,700	66,140	62,580	59,990
Lime do	2,157,650	2,246,990	2,187,040	2.373,850	2,771,080	2,785,990
Manganese ore do	(2)	(2)	(2)	(2)	(2)	(2)
Marls and chalk for cement, etc. tons	764,955	2,824,530	2.214,570	2,385.410	3,100,750	3,140,400
Mineral paint ores: Ocher tons	300	410	540	860	680	1,570
Nickel, metallic [7] do	1,490	(2)	(2)	(2)	(2)	(2)
Peat do	(4)	(4)	1,000	(4)	(4)	(4)
Phosphate rock do	26,250	15,125	30,030	39,760	15,510	40,330
Phosphatic chalk do	257,872	317,514	762,768	364,176	83,010	58,950
Pyrite do	(2)	(2)	(2)	(2)	(2)	(2)
Sand:						
For glass-making do	968,924	921,690	1,080,853	1,032,194	996,835	1,212,922
For building, etc. do	988,397	946,591	1,034,348	1,068,841	1,147,126	1,247,851
Silica:						
For pottery do	67,050	31,644	35,838	46,134	21,096	19,638
For other purposes do	4,176	3,805	16,992	4,014	24,120	32,328
Silver kilograms	111,880	130,170	105,048	123,043	112,950	110,790
Slate (roofing slates) number	33,570,000	28,800,000	31,810,000	36,570,000	36,410,000	32,590,000
Stone:						
Building stone, dressed tons	371,300	357,300	367,581	321,261	439,277	365,667
Dolomite do	179,850	214,935	233,010	163,635	153,100	283,080
Flagstones do	8,264	7,079	7,063	4,761	11,429	12,824
Limestone, for glass-making and other industrial uses tons	251,055	168,660	369,615	453,885	235,515	413,085
Marble do	46,050	43,955	47,464	51,925	55,298	49,694
Paving stones number	62,182,000	69,352,000	110,910,000	83,550,000	80,896,000	94,700,000
Rubble tons	5,146,404	5,320,649	4,498,005	5,193,000	5,528,745	6,233,790
Tin (smelter product) do		(2)	(2)	(2)	(2)	(2)
Zinc:						
Ore do	850	10,201	12,461	14,090	(4)	(4)
Crude zinc kilograms	161,700,000	170,860,000	188,767,000	199,090,000	206,300,000	197,900,000
Zinc dust tons	3,350	2,565	4,281	4,850	4,030	3,860

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[1] Source of data: Statistique des Industries Extractives et Métallurgiques et des Appareils à Vapeur en Belgique, Brussels (annual).

[2] Production is reported, but figures are not shown separately.

[3] Figures represent only output of plants connected with quarries of hard limestone and therefore do not cover total output of country, for which data are not available.

[4] Data not available.

[5] Not reported separately. Production of fine gold and platinum metals reported as follows: 1928, 4,690 kilos; 1929, 3,170 kilos.

[6] Includes ferro-alloys.

[7] Produced from nickel matte.

BERMUDA ISLANDS

Limestone is quarried for local use, and some lime is manufactured, but there is no other mineral industry in the Bermudas. No data of production are available.

BOLIVIA

Mineral production of Bolivia, 1924–1929, in kilograms [1]

[Exports]

Mineral	1924	1925	1926	1927	1928	1929
Antimony ore, gross weight	1, 409, 731	3, 146, 415	7, 408, 670	6, 717, 655	5, 834, 338	6, 093, 312
Antimony content	[2] 775, 352	[2] 1, 730, 528	4, 354, 778	4, 016, 726	3, 542, 879	3, 778, 541
Asbestos	51			209		
Bismuth:						
Ore, gross weight	151, 427	168, 033	166, 334	164, 467	92, 847	98, 432
Bismuth content	(3)	42, 018	43, 098	49, 017	27, 811	25, 076
Concentrates, gross weight	14, 320	18, 968	6, 000	3, 426	20, 431	5, 897
Bismuth content	(3)	7, 155	2, 660	2, 721	10, 161	2, 936
Bars, gross weight	174, 959	326, 671	202, 028	42, 425	97, 965	129, 090
Bismuth content	(3)	(3)	177, 330	36, 389	82, 822	112, 135
Residues, gross weight	58, 480	28, 825		60, 975	41, 850	25, 250
Bismuth content	(3)	5, 772		20, 383	15, 316	10, 925
Copper:						
Ore, gross weight	10, 607, 000	2, 249, 506	6, 021, 008	10, 309, 186	8, 937, 063	12, 566, 701
Copper content	(4)	581, 321	984, 912	1, 621, 407	1, 471, 599	2, 121, 747
Concentrates, gross weight	701, 401	1, 089, 588	1, 628, 140	1, 428, 332	1, 405, 172	1, 232, 520
Copper content	(4)	748, 558	1, 127, 583	982, 187	970, 749	885, 981
Bars, gross weight			46			
Copper content			46			
Cement, gross weight	207, 406	145, 288	151, 266	132, 445	110, 432	221, 165
Copper content	(4)	75, 228	74, 500	65, 051	54, 400	124, 899
Sulphide, gross weight	9, 575, 000	11, 175, 000	11, 675, 000	12, 126, 186	11, 875, 500	8, 190, 500
Copper content	(4)	5, 829, 950	5, 942, 554	6, 060, 817	5, 988, 804	4, 055, 273
Gold, fine [5]	30	12	10	8	16	47
Lead:						
Ore, gross weight	14, 813, 906	20, 671, 529	21, 184, 985	20, 552, 778	17, 415, 139	19, 615, 024
Lead content	(3)	13, 810, 771	14, 112, 063	14, 293, 909	12, 425, 012	14, 090, 960
Bars, gross weight	264					
Lead content	(3)					
Slags, gross weight	18, 807, 922	16, 166, 239	9, 724, 396	2, 129, 611	603, 085	1, 990, 979
Lead content	(3)	7, 229, 849	4, 350, 751	1, 011, 828	280, 371	864, 631
Mercury, metallic					1, 575	1, 741
Mica		10	24, 665	16, 717	11, 285	1, 986
Silver, fine	[5] 151, 092	[5] 135, 196	[6] 181, 462	[5] 168, 051	[5] 175, 389	[5] 149, 805
Silver:						
Ore, gross weight	13, 205, 867	10, 944, 728	11, 362, 378	5, 487, 239	10, 898, 721	9, 301, 787
Silver content	(3)	(3)	52, 254	62, 505	73, 150	56, 722
Bars, gross weight	203					
Silver content	(3)					
Cement, gross weight	178, 842	206, 081	230, 516	144, 412	89, 671	2, 496
Silver content	(3)	(3)	42, 785	19, 514	3, 144	251
Sulphides, gross weight	161, 392	192, 148	233, 068	225, 331	239, 852	296, 838
Silver content	(3)	(3)	86, 423	86, 032	99, 076	136, 325
Stone			57			
Tin:						
Concentrates, gross weight	53, 430, 925	54, 268, 034	53, 639, 608	66, 621, 106	70, 134, 005	78, 340, 903
Tin content	(7)	32, 682, 036	30, 542, 581	36, 379, 013	41, 020, 365	45, 834, 467
Bars, gross weight	4, 642	61, 586		3, 012		
Tin content	(7)	58, 583		2, 892		
Slags, gross weight					6, 340, 277	6, 873, 516
Tin content					1, 053, 811	1, 252, 166
Tungsten concentrates, gross weight [8]	436	76, 288	100, 575	79, 613	28, 421	1, 524, 262
Zinc ore, gross weight	485, 445	6, 209, 982	17, 560, 152	12, 888, 830	5, 528, 802	2, 971, 852
Zinc content	(3)	2, 749, 621	7, 601, 067	5, 636, 558	2, 260, 873	1, 395, 028

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[1] Source of data: Comercio Especial de Bolivia; information furnished by the American consulate, La Paz; other sources as noted.

[2] Estimated.

[3] Data not available.

[4] Data not available. Total copper content of exports reported as 7,439 tons. (Am. Bur. Metal Statistics.)

[5] Production. Figures as published by the Director, U. S. Mint.

[6] Exports. Figures as published by the Director, U. S. Mint.

[7] Data not available. Total tin content of exports reported as 32,117 tons (Imp. Inst., London)

[8] Average content of WO_3 reported as follows: 1924, not stated; 1925, 51.08 per cent; 1927, 64.88 per cent; 1928, 61.81 per cent; 1929, 64.16 per cent.

BRAZIL

Mineral production of Brazil, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Agate ....kilograms..	153, 787	77, 488	129, 678	130, 255	161, 595	483, 269
Arsenic, white [2] ....tons..	146	([3])	51	([3])	([3])	([3])
Asbestos ....kilograms..	308	334	-----	-----	-----	-----
Chromite ....tons..	-----	-----	1, 500	1, 820	20	70
Coal [4] ....do....	342, 200	392, 376	400, 000	400, 000	400, 000	400, 000
Crystal ....kilograms..	202, 715	150, 152	161, 180	269, 465	308, 965	498, 496
Diamonds, industrial (carbonado) [5]	($677, 670)	($938, 174)	($1,088,528)	($1,205,178)	($1,310,343)	($815, 816)
Gems:						
Diamonds [5]	($630, 328)	($417, 138)	($755, 752)	($405, 110)	($493, 152)	($269, 641)
Other gem stones [5]	($127, 989)	($59, 983)	($43, 226)	($37, 131)	($68, 956)	($27, 655)
Gold, fine [6] ....kilograms..	4, 500	3, 375	3, 176	3, 190	3, 114	3, 340
Graphite ....do....	50	-----	-----	-----	9	15, 130
Iron:						
Ore [7] ....tons..	-----	30, 000	30, 000	30, 000	30, 000	30, 000
Pig iron [8] ....do....	70, 000	70, 000	70, 000	70, 000	70, 000	70, 000
Lead ore ....do....	252	251	320	787	463	-----
Lime ....do....	26	13	16	39	57	31
Manganese ore ....do....	159, 229	[9] 331, 827	[9] 260, 536	[9] 273, 494	[9] 359, 651	[9] 316, 172
Mica ....do....	79	65	52	39	44	45
Monazite sand ....do....	-----	20	199	200	2, 102	90
Salt ....do....	172	61	4	41	60	20
Silver, fine [6] ....kilograms..	890	57	643	484	796	654
Stone ....tons..	502	4, 704	7, 199	11, 532	12, 464	([3])
Talc ....kilograms..	120	158	-----	-----	-----	-----
Titanium ore (ilmenite) .tons..	210	1, 500	1, 498	1, 307	2, 102	6, 361
Zirconium sand ....do....	764	124	11	259	828	1, 077

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[1] Source of data: Commercio Exterior do Brasil, except as otherwise noted. Figures relate to exports except as otherwise noted.

[2] Production as reported by the St. John del Rey Mining Co. Exports are reported as follows: 1924, 240 tons; 1925, 69 tons; 1926–1928, inclusive, none exported.

[3] Data not available.

[4] Production. Figures for 1926–1929, inclusive, estimated annual output.

[5] Quantity not reported. Values converted from milreis at the annual average rate of exchange, as compiled by the U. S. Federal Reserve Board.

[6] Production figures as published by the Director, U. S. Mint.

[7] Approximate production.

[8] Official estimate of annual production.

[9] Production. Data supplied by the operating companies through the American consulate, Rio de Janeiro.

BRITISH BORNEO

Mineral production of British Borneo, 1924–1929 [1]

Mineral and State	1924	1925	1926	1927	1928	1929
Coal:						
Brunei ....tons..	10, 503	687	-----	53	-----	-----
North Borneo ....do....	90, 847	81, 224	72, 585	63, 707	61, 754	59, 276
Sarawak ....do....	19, 263	19, 993	19, 998	16, 706	17, 967	13, 824
Total ....do....	120, 613	101, 904	92, 583	80, 466	79, 721	73, 100
Gold: Sarawak ....grams..	26, 678	22, 076	7, 748	-----	-----	30, 233
Petroleum:						
Brunei ....tons..	-----	-----	-----	-----	[2] 1, 016	[2] 1, 500
Sarawak ....do....	599, 422	612, 923	711, 637	711, 756	751, 090	760, 166
Total ....do....	599, 422	612, 923	711, 637	711, 756	752, 106	761, 666

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[1] Source of data: Coal and gold—data furnished by American consul general, Singapore, Straits Settlements; petroleum—annual reports of the Royal Dutch Shell Co., except as otherwise noted.

[2] Data furnished by the American consul general, Singapore.

BRITISH GUIANA

Mineral production of British Guiana, 1924–1929 [1]

Mineral [2]		1924	1925	1926	1927	1928	1929
Bauxite [3]	tons	156, 800	177, 808	189, 101	163, 454	168, 077	188, 123
Diamonds	number	1, 055, 425	1, 160, 271	1, 208, 599	1, 295, 847	967, 470	937, 489
	carats	185, 586	182, 896	164, 157	173, 797	132, 483	125, 799
Gold, crude	grams	223, 541	283, 259	231, 721	209, 109	189, 202	226, 869
Stone	tons	20, 646	25, 228	24, 094	15, 599	29, 374	(4)

[1] Source of data: Report on the Lands and Mines Department, Georgetown, British Guiana (annual).

[2] In addition to the minerals listed, the following are reported, but no figures of production are available: Magnesite—samples of concretionary magnesite brought from the Rupumuni district; Manganese—Manganiferous laterite, containing 24.40 to 33.65 per cent of manganese oxide, quarried for road metal at Saxacali, on the Essequibo River; rutile and zircon—prospecting for these minerals in progress on the Berbice River, samples of rutile submitted for analysis showed high titanium content.

[3] Exports.

[4] Data not available.

BRITISH HONDURAS

British Honduras has no mining industry of commercial importance. Ower [11] reports the existence of diatomaceous earth, gold, molybdenite, monazite, petroleum, and tin. Gold quartz assaying 1 pennyweight per ton has been found. Traces of tin have been reported from numerous localities, but payable deposits have not been located; samples indicate that the Vaca Pine Ridge district is the most promising area. Indications of petroleum have been noted.

BRITISH WEST AFRICA

Cameroons.—This British mandate territory is now united with Nigeria for administrative purposes. No mineral production is reported.

Gambia.—A few occurrences of gold and iron have been noted in the Colony [12] but so far no mineral deposits of economic value have been discovered. Salt for domestic use is occasionally collected by the natives by evaporation of sea water left by the tide in ditches dug in the mud flats on the lower reaches of the Gambia River.

Gold Coast and Ashanti.—See Gold Coast and Ashanti (p. 903).

Nigeria.—See Nigeria (p. 923).

Sierra Leone.—See Sierra Leone (p. 938).

Togoland.—This British mandate territory is now united with the Gold Coast for administrative purposes. No mineral production is reported.

BRITISH WEST INDIES

Bahamas.—There are no mines in the Bahamas. Limestone is quarried for local use, and small quantities are exported. Salt is produced by the evaporation of sea water; figures of output are not available, but the quantities exported are given in the accompanying table.

Barbados.—Chalk, diatomite, limestone and sandstone, manjak, and petroleum are produced in Barbados. The output of chalk and diatomite is very small. About a dozen of the larger sandstone quarries are worked regularly and a number of smaller ones intermittently.

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[11] Ower, Leslie H., Mineral Resources of British Honduras: Min. Mag., London, vol. 32, 1925, pp. 49–50; also Min. Jour., London, vol. 148, 1925, p. 58. (Economic Geology of British Honduras.)

[12] Cooper, W. G. G., Report on a Rapid Geological Survey of the Gambia, British West Africa: Gold Coast Geol. Surv., Bull. 3, 1927, pp. 32–34.

Limestone is quarried in many parts of the island, and small quantities are exported for building purposes to the neighboring islands and Demerara. No figures on the production of stone are available. Manjak has been mined in the island since 1895; the exports for the period under review are reported as follows: 1924, 71 tons; 1925, 30 tons; 1926, 109 tons; 1927, 46 tons; 1928, 60 tons; 1929, 51 tons. Salt for domestic consumption is produced by evaporation of sea water. The average output of petroleum is estimated to be about 12,000 hectoliters a year.

Jamaica.—Except for the quarrying of limestone and other material for road building, no mineral industry exists in the island of Jamaica. There are phosphate deposits on Cayman Islands, but they have not been worked for some time. The salt industry of Turks and Caicos Islands, which dates from 1678, is the most important of the British West Indies. There are 230 acres of salt ponds at Grand Turk, 120 at Salt Cay, and 400 at Cockburn Harbor, on South Caicos Islands.[13] The yearly output per acre is estimated roughly to be about 145 tons but depends upon fine weather, and the actual production ranges from 54,000 tons in poor seasons to about 82,000 in good years. Details of the exports of salt appear in the table below.

Leeward Islands.—A deposit of phosphate rock occurs on the island of Redonda, but so far as known there has been no production in recent years. Salt is produced from sea water and exported.

Trinidad and Tobago.—See Trinidad (p. 946.)

Windward Islands.—The only mineral industry reported is the making of salt from sea water on the island of Grenada. Exports of salt are given in the following table:

Salt exported from the British West Indies, 1924–1929, in tons [a]

Islands	1924	1925	1926	1927	1928	1929
Bahamas	1, 595	1, 312	7, 476	1, 923	725	813
Jamaica (Turks and Caicos Islands)	53, 167	63, 434	54, 824	28, 371	50, 846	62, 135
Leeward Islands	1, 207	802	614	1, 214	1, 586	1, 310
Windward Islands (Grenada)	54	71	56	([b])	37	70

[a] Source of data: Publications, Imp. Inst., London.

[b] Data not available.

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[13] Handbook of Jamaica, 1930.

BULGARIA

Mineral production of Bulgaria, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Bauxite tons	796	-----	-----	-----	-----	-----
Clay: Kaolin do	-----	-----	-----	2,841	2,742	3,613
Coal:						
Anthracite do	1,383	1,510	1,518	2,656	1,202	2,519
Bituminous do	68,755	55,654	62,463	66,536	68,334	76,336
Lignite do	1,155,322	1,166,032	1,141,777	1,168,454	1,360,790	1,572,964
Coke, metallurgical do	-----	1,193	1,582	1,448	898	-----
Copper:						
Ore do	25,916	28,270	35,536	10,934	10,912	31,370
Matte do	1,511	1,746	-----	-----	-----	-----
Copper-lead ore do	-----	131	-----	18,789	8,787	9,923
Gold, fine grams	1,500	-----	-----	-----	-----	-----
Iron ore tons	300	-----	-----	-----	-----	-----
Lead ore do	8,108	9,165	[2] 11,241	[2] 1,299	1,324	3,983
Lead-zinc ore do	-----	27	-----	6,720	14,762	11,396
Manganese ore do	300	565	490	7	-----	-----
Salt:						
Rock salt do	571	-----	1,284	3,982	4,108	3,653
Other salt do	[3] 19,000	[3] 10,400	[3] 14,000	[3] 30,980	42,709	25,194
Stone [4] do	(4)	(4)	(4)	(4)	(4)	(4)
Zinc ore do	-----	-----	425	1,495	-----	1,365

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[1] Source of data: Annuaire Statistique du Royaume de Bulgarie, Sofia (annual); information supplied by the Ministry of Commerce, Industry, and Labor, Bulgaria; other sources as noted.

[2] Includes a small quantity of silver-lead ore.

[3] Stammatiu, M. I., Les Exploitations de Sel Marin à Atanashioi, Bulgarie; Ann. des Mines de Roumanie, vol. 13, No. 3, Bucharest, 1930, pp. 111–117.

[4] Limestone and marble produced but no records of output kept.

CANADA

Mineral production of Canada, 1924–1929 [1] [2]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Diatomite tons	30	-----	-----	241	334	389
Garnets do	327	-----	-----	-----	-----	-----
Grinding pebbles do	(3)	95	58	-----	-----	-----
Grindstones, etc do	2,441	2,324	2,445	2,042	1,683	1,766
Pumice (volcanic ash) tons	222	145	82	95	440	272
Actinolite do	82	36	73	78	64	27
Antimony ore do	-----	-----	-----	11	-----	-----
Antimony, metallic [4] kilograms	-----	794	724	-----	-----	-----
Arsenic, white [5] tons	2,096	1,558	2,302	2,825	2,464	2,372
Asbestos do	[6] 150,768	[7] 248,136	[7] 253,469	[7] 249,273	[7] 247,690	[7] 277,647
Barite do	137	86	91	51	115	95
Beryl crystals kilograms	-----	-----	-----	-----	-----	2,021
Bismuth, metallic [8] kilograms	5,835	8,921	2,921	919	6,351	88,146
Bituminous sand tons	482	1,041	479	2,455	85	897
Cadmium kilograms	-----	-----	-----	-----	223,118	351,068
Cement tons	1,190,455	1,288,563	1,382,296	1,598,021	1,750,120	1,950,178
Chromite do	-----	-----	-----	-----	-----	114

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[1] Source of data: Publications of the Dominion Bureau of Statistics, Ottawa, as follows—Annual Report on the Mineral Production of Canada; Manufactures of the Nonmetallic Minerals in Canada (annual); Iron and Steel and Their Products in Canada (annual); Coal and Coke Statistics (annual). Other publications as noted.

[2] Figures represent sales and shipments, except as otherwise noted.

[3] Data not available.

[4] Recoverable antimony content of silver-lead-bismuth bullion exported by Canadian smelters.

[5] Figures include estimated arsenic content of ores exported, as follows: 1924, 465 tons; 1925, 648 tons; 1926, 495 tons; 1927, 605 tons; 1928, 643 tons; 1929, 694 tons.

[6] Exclusive of by-products (fillers and other short fibers, sand, and gravel), the production of which is reported as 54,023 tons.

[7] Exclusive of sand and gravel, which is included under "Sand and gravel."

[8] Recoverable bismuth content of silver-lead-bismuth bullion exported by Canadian smelters.

Mineral production of Canada, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Clay: [9]						
Bentonite .... tons	----------	----------	27	----------	18	----------
Fire clay .... do	3,307	565	2,279	4,599	4,647	4,573
Kaolin .... do	----------	----------	----------	22	5	----------
Coal mined:						
Bituminous .... do	9,138,841	8,627,519	11,687,032	12,340,507	12,439,470	12,272,806
Lignite .... do	3,233,459	3,288,262	3,261,599	3,468,793	3,494,505	3,599,720
Cobalt [10] .... kilograms	430,323	506,430	301,537	399,427	433,900	421,573
Coke: [11]						
Metallurgical .... tons	893,849	979,325	1,411,537	1,435,759	1,796,753	2,152,039
Gas-house .... do	409,689	423,846	427,369	402,585	302,577	277,009
Coke by-products:						
Ammonium sulphate .... tons	15,733	16,557	21,459	22,415	25,483	30,971
Light oils (benzol, toluol, etc.) .... liters	8,225,284	9,544,763	14,816,489	13,474,423	18,414,570	27,525,406
Tar and tar products .... liters	86,362,577	85,438,727	113,362,297	116,531,113	123,319,356	136,850,851
Copper:						
Metallic copper (total output) [12] .... kilograms	47,380,853	50,552,840	60,370,535	63,569,477	91,940,900	112,545,096
Refined copper .... tons	1,796	173	10,751	9,339	7,989	3,191
Copper sulphate .... kilograms	57,742	55,223	183,641	257,106	349,899	280,060
Feldspar .... tons	40,645	26,019	32,614	27,078	28,936	34,044
Fluorspar .... do	70	3,525	----------	----------	----------	16,211
Gold, fine .... grams	47,444,690	53,987,401	54,561,597	57,628,063	58,803,992	59,977,091
Graphite .... tons	1,210	2,331	2,474	1,659	995	1,325
Gypsum:						
Crude mined .... do	638,413	640,335	844,760	1,003,073	1,189,895	1,111,956
Shipments, crude or calcined .... tons	586,053	671,606	801,700	964,438	1,130,680	1,099,220
Ilmenite .... do	1,277	3,609	181	1,841	2,036	2,493
Iron:						
Ore [13] .... do	65	----------	----------	----------	----------	----------
Pig iron [14] .... do	638,164	606,048	827,438	778,220	1,099,578	1,188,043
Iron oxide [15] .... do	6,592	6,457	6,011	5,556	4,911	5,913
Lead:						
Ore and concentrates .... do	139,158	189,227	231,374	249,772	232,187	234,237
Metallic lead (total output) [16] .... kilograms	79,598,467	115,026,150	128,729,416	141,258,432	153,289,238	148,107,371
Refined lead [17] .... tons	59,180	96,713	116,697	134,157	136,561	138,095
Lime: [18]						
Hydrated .... do	41,808	54,839	59,705	64,631	72,546	84,825
Quicklime .... do	248,302	270,820	315,777	338,840	389,108	526,693
Magnesite:						
Crude mined .... do	9,512	3,827	11,429	18,523	33,311	39,216
Shipments—						
Crude .... do	----------	1,367	----------	----------	----------	----------
Calcined .... do	1,393	3,691	4,147	6,656	11,970	17,063
Dead-burned .... do	2,121					
Manganese ore .... do	530	----------	----------	----------	[19] 349	[19] 273
Mercury, metallic .... kilograms	----------	----------	208	----------	----------	----------
Mica .... tons	3,711	3,647	2,309	2,484	3,320	3,677
Molybdenite:						
Concentrates .... do	9	14	12	----------	----------	9
Content MoS_2 .... kilograms	8,500	10,138	9,500	----------	----------	7,325
Natro-alunite .... tons	----------	18	----------	6	----------	----------
Natural gas .... cubic meters	421,394,791	478,639,334	543,918,854	605,326,590	639,471,088	803,592,908

[9] In addition to the kinds of clay enumerated, brick and pottery clays are produced, but the quantity is not recorded, returns being made only on the products made therefrom. The value of clay products made from domestic material is reported as follows: 1924, $9,215,077; 1925, $9,529,691; 1926, $10,357,323; 1927, $11,173,189; 1928, $12,381,718; 1929, $13,904,643.

[10] Cobalt content of all smelter products sold or shipped.

[11] Includes coke breeze. Production of metallurgical coke exclusive of breeze reported as follows: 1924, 833,691 tons; 1925, 959,438 tons; 1926, 1,329,314 tons; 1927, 1,366,623 tons; 1928, 1,675,421 tons; 1929, 1,986,532 tons.

[12] Figures represent blister copper produced and copper contained in ores, concentrates, and mattes exported and in copper sulphate produced.

[13] Exclusive of iron oxide, used for paint and the purification of gas, and of titaniferous iron ore, which is recorded as ilmenite.

[14] Includes ferro-alloys.

[15] Used for paint and for purification of gas.

[16] Figures represent lead in base bullion and pig lead produced in Canada and recoverable lead contained in ores and concentrates exported.

[17] Produced in British Columbia and Ontario.

[18] Sold or used.

[19] Bog ore.

Mineral production of Canada, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Nickel:						
Ore mined [20] ....tons..	1, 280, 920	1, 147, 354	1, 199, 337	1, 184, 702	1, 322, 587	1, 807, 021
Metallic nickel [21] ....kilograms..	31, 540, 993	33, 500, 848	29, 807, 347	30, 299, 230	43, 887, 363	50, 020, 051
Peat.......................tons..	------------	1, 243	------------	------------	1, 358	2, 365
Petroleum, crude..hectoliters..	255, 671	527, 968	579, 561	757, 904	992, 615	1, 776, 906
Phosphate rock..........tons..	------------	15	36	137	582	1, 075
Platinum metals:						
Palladium, rhodium, etc...............grams..	295, 981	257, 786	311, 781	359, 090	423, 225	538, 650
Platinum—						
From placers...do....	156	187	1, 555	342	1, 524	871
From mattes, etc.............do....	285, 561	270, 351	294, 581	348, 888	326, 058	388, 514
Pyrite [22] ....tons..	21, 366	14, 157	16, 189	46, 142	62, 447	70, 087
Quartz (silica)..........do....	136, 890	178, 918	210, 540	212, 266	256, 598	241, 264
Salt:						
Production..........do....	191, 176	216, 729	235, 938	245, 756	273, 525	299, 518
Shipments..........do....	188, 674	212, 050	238, 177	243, 734	271, 621	299, 609
Sand and gravel.........do....	10, 525, 303	9, 995, 896	15, 524, 388	20, 822, 338	25, 494, 404	25, 262, 192
Silver, fine.........kilograms..	613, 868	629, 192	695, 845	707, 190	682, 299	719, 836
Sodium carbonate.......tons..	463	1, 016	540	730	471	544
Sodium sulphate, natural:						
Crude...............tons..	875	3, 516	6, 146	5, 134	5, 458	4, 552
Refined..............do....	107	------------	------------	------------	------------	------------
Stone:						
Granite...............do....	380, 989	881, 523	965, 623	662, 286	1, 084, 815	1, 567, 757
Limestone..........do....	3, 854, 663	4, 212, 811	4, 793, 308	5, 840, 769	6, 304, 375	7, 004, 192
Marble...............do....	4, 299	2, 763	4, 804	4, 726	7, 033	12, 711
Sandstone...........do....	85, 822	79, 380	40, 031	120, 473	91, 581	144, 611
Talc and soapstone.....do....	10, 280	13, 130	14, 304	14, 988	14, 567	[23] 14, 069
Zinc:						
Metallic zinc (total output) [24]...kilograms..	44, 864, 168	49, 563, 104	68, 010, 425	75, 067, 115	83, 754, 202	89, 478, 378
Refined zinc [25]......tons..	24, 897	34, 892	55, 998	66, 413	74, 176	78, 061

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[20] Nickel-copper ore mined in Ontario. (Ontario Dept. Mines, Ann. Rept.)

[21] Figures represent refined and electrolytic nickel produced in Canada, the nickel equivalent in oxides and salts sold, and the nickel content of mattes and speiss exported.

[22] Sulphur content reported as follows: 1924, 8,838 tons; 1925, 6,883 tons; 1926, 8,142 tons; 1927, 22,887 tons; 1928, 35,007 tons; 1929, 39,949 tons. Figures for 1928 and 1929 include content of smelter gases used for making acid.

[23] Talc only. Quantity of soapstone not reported, value given in 1929 as $47,986.

[24] Figures represent refined zinc produced at Trail, British Columbia, and recoverable zinc in ores exported.

[25] Produced at Trail, British Columbia.

Mineral production of Canada, 1924–1929, by Provinces

Province and mineral	1924	1925	1926	1927	1928	1929
ALBERTA						
Bituminous sand.......tons..	482	1, 041	479	2, 455	85	897
Clay, fire clay...........do....	------------	------------	------------	------------	------------	43
Cement.....................do....	66, 127	62, 845	67, 276	95, 524	132, 413	128, 402
Coal mined:						
Bituminous.........do....	1, 909, 206	2, 464, 163	3, 037, 413	3, 248, 310	3, 588, 795	3, 413, 581
Lignite..............do....	2, 798, 813	2, 860, 105	2, 862, 618	3, 042, 223	3, 066, 577	3, 073, 384
Gold, fine.............grams..	------------	------------	------------	1, 306	2, 115	155
Lime:						
Hydrated...........tons..	13	------------	------------	------------	------------	------------
Quicklime...........do....	2, 852	3, 141	3, 439	4, 147	6, 052	6, 968
Natural gas.....cubic meters..	201, 930, 962	258, 236, 882	305, 673, 435	380, 428, 163	404, 610, 428	541, 220, 867
Petroleum, crude..hectoliters..	1, 342	291, 799	343, 576	506, 881	766, 580	1, 572, 250
Salt (shipments).........tons..	------------	756	1, 848	91	------------	------------
Sand and gravel.........do....	558, 393	485, 243	1, 592, 070	1, 263, 477	2, 336, 631	1, 562, 101
Silver, fine.............grams..	------------	------------	------------	124	218	------------
Stone:						
Limestone..........tons..	14, 894	3, 610	3, 216	3, 054	4, 402	4, 513
Sandstone...........do....	254	------------	194	------------	143	188
BRITISH COLUMBIA						
Abrasives:						
Diatomite...........tons..	------------	------------	------------	------------	145	159
Grindstones, etc....do....	218	436	635	345	223	191

Mineral production of Canada, 1924–1929, by Provinces—Continued

Province and mineral	1924	1925	1926	1927	1928	1929
BRITISH COLUMBIA—contd.						
Arsenic, white tons	224	580	462	559	606	674
Bismuth, metallic kilograms						75, 097
Cadmium do					223, 118	351, 068
Cement tons	74, 985	77, 026	86, 501	83, 177	106, 493	108, 098
Chromite do						114
Clay:						
Bentonite do			27		18	
Fire clay do	1, 191	188	1, 018	1, 198	1, 010	1, 107
Coal, bituminous, mined tons	1, 990, 051	2, 487, 716	2, 371, 114	2, 491, 337	2, 544, 272	2, 259, 221
Coke [1] do	118, 296	163, 550	182, 458	152, 882	120, 362	143, 015
Copper						
Metallic copper kilograms	29, 688, 031	31, 398, 225	40, 418, 506	41, 587, 987	46, 394, 641	47, 129, 097
Refined copper tons	1, 796	173	10, 751	9, 339	7, 989	3, 191
Copper sulphate kilograms	[2] 57, 742	[2] 55, 223	183, 641	257, 105	349, 899	280, 040
Fluorspar tons		3, 514				16, 148
Gold, fine grams	7, 642, 716	6, 818, 723	7, 025, 219	5, 694, 861	6, 115, 473	4, 796, 281
Gypsum:						
Crude mined tons	27	(3)	(3)	(3)	(3)	(3)
Shipments, crude or calcined tons	27	218	18, 975	22, 219	19, 034	22, 404
Iron ore do	25					
Iron oxide do	109	120	98	176	123	270
Lead, metallic kilograms	76, 415, 231	109, 974, 938	121, 023, 464	132, 797, 791	144, 115, 588	139, 705, 336
Lime:						
Hydrated tons	3, 771	4, 280	7, 163	7, 199	9, 649	12, 057
Quicklime do	16, 434	16, 354	15, 972	14, 674	22, 237	23, 859
Manganese ore (bog ore) tons						1
Mercury, metallic kilograms			208			
Natro-alunite tons		18		6		
Phosphate rock do				35	499	1, 039
Platinum metals:						
Palladium, rhodium, etc. grams						5, 505
Platinum						
From placers do	156	187	1, 555	342	1, 524	871
From mattes, etc. grams					964	529
Pyrite tons	7, 340	2, 422	3, 061	33, 910	58, 044	51, 161
Quartz (silica) do	19, 376	774	5, 866	18, 923	14, 530	8, 747
Sand and gravel do	1, 002, 740	1, 283, 870	1, 348, 301	1, 251, 131	2, 117, 603	2, 200, 815
Silver, fine kilograms	253, 587	266, 851	330, 500	343, 396	340, 377	315, 900
Sodium carbonate tons	463	1, 016	540	730	471	544
Stone:						
Granite do	136, 551	174, 339	147, 940	158, 707	182, 370	260, 254
Limestone do	24, 542	52, 773	74, 247	73, 489	61, 851	108, 156
Marble do				544	862	178
Sandstone do	589	5, 332	7, 384		1, 161	2, 386
Talc and soapstone do	150	83		97		[4] 41
Zinc:						
Metallic zinc kilograms	43, 544, 671	44, 974, 794	62, 157, 220	67, 270, 336	74, 175, 976	78, 061, 406
Refined zinc tons	24, 897	34, 892	55, 997	66, 413	74, 176	78, 061
MANITOBA						
Cement tons	45, 555	64, 677	97, 183	87, 586	110, 090	158, 798
Coke [1] do	25, 809	27, 814	31, 306	32, 332	31, 426	40, 458
Gold, fine grams	36, 702	137, 602	5, 847	5, 661	616, 253	698, 429
Gypsum:						
Crude mined tons	28, 625	(3)	(3)	(3)	(3)	(3)
Shipments, crude or calcined tons	26, 648	31, 831	31, 907	36, 192	46, 525	61, 025
Lime:						
Hydrated do		3, 994	5, 922	7, 233	7, 558	9, 134
Quicklime do	12, 517	10, 304	15, 840	13, 373	18, 149	20, 119
Natural gas cubic meters	5, 663	5, 663	5, 663	5, 663	5, 663	16, 990
Quartz (silica) tons					4	9, 113
Sand and gravel do	326, 127	659, 658	897, 727	1, 209, 797	1, 500, 411	1, 616, 672
Silver, fine grams	4, 354	14, 836	560	373	54, 835	82, 238
Stone:						
Granite tons					103, 419	
Limestone do	49, 046	47, 872	92, 143	140, 310	110, 552	173, 731
Marble do						547

[1] Metallurgical and gas-house coke, including breeze.

[2] Ontario included with British Columbia.

[3] Data not available.

[4] Talc only.

Mineral production of Canada, 1924–1929, by Provinces—Continued

Province and mineral	1924	1925	1926	1927	1928	1929
NEW BRUNSWICK						
Abrasives: Grindstones, etc. ....tons	1, 917	1, 490	1, 528	1, 687	1, 460	1, 570
Antimony ore..........do				11		
Clay, fire clay..........do	45	44	42	48	61	43
Coal, bituminous, mined ....tons	196, 968	188, 705	157, 043	185, 019	188, 456	198, 406
Coke [1]..........do	[5] 381, 501	[6] 278, 734	[6] 439, 765	[6] 378, 639	[6] 420, 109	[6] 452, 755
Gypsum:						
Crude mined..........do	86, 764	(3)	(3)	(3)	(3)	(3)
Shipments, crude or calcined..........tons	78, 687	65, 085	54, 019	77, 376	68, 068	63, 940
Lime:						
Hydrated..........do					23	3, 404
Quicklime..........do	6, 610	6, 417	15, 152	10, 894	10, 216	
Manganese ore..........do	530				[7] 349	[7] 272
Natural gas.....cubic meters	16, 989, 407	18, 101, 217	18, 358, 364	17, 861, 089	18, 716, 999	19, 211, 838
Petroleum, crude..hectoliters	8, 844	8, 549	16, 768	29, 013	12, 791	11, 926
Sand and gravel..........tons	128, 712	63, 644	64, 347	352, 046	445, 853	477, 047
Stone:						
Granite..........do	4, 464	8, 189	3, 469	1, 482	4, 976	4, 665
Limestone..........do	12, 980	14, 845	13, 657	22, 792	27, 916	18, 788
Sandstone..........do			209	2, 857	9, 140	1, 361
NOVA SCOTIA						
Abrasives:						
Diatomite..........tons	30			241	189	230
Grindstones, etc..........do	306	398	282	10		5
Arsenic, white..........do	173			16		
Barite..........do	137	86	91	51	115	95
Clay, fire clay..........do	1, 785	44	486	2, 439	2, 372	2, 696
Coal, bituminous, mined ....tons	5, 041, 599	3, 486, 273	6, 121, 176	6, 415, 465	6, 117, 572	6, 401, 183
Coke [1]..........do	(6)	(6)	(6)	(6)	(6)	(6)
Gold, fine..........grams	32, 566	50, 574	52, 192	98, 007	40, 123	83, 575
Gypsum:						
Crude, mined..........tons	433, 799	(3)	(3)	(3)	(3)	(3)
Shipments, crude or calcined..........tons	400, 749	500, 065	615, 165	752, 450	919, 207	860, 818
Iron, pig [8]..........do	179, 920	205, 034	254, 254	253, 554	307, 810	315, 790
Lime:						
Hydrated..........do	71	260	228	9	562	907
Quicklime..........do		2	14, 181	27, 716	32, 238	37, 195
Quartz (silica)..........do		1, 227	7, 560	4, 385	6, 735	10, 746
Salt (shipments)..........do	4, 128	5, 986	7, 407	13, 055	17, 783	25, 237
Sand and gravel..........do	278, 358	259, 920	208, 929	737, 515	268, 766	301, 727
Silver, fine..........grams	1, 369	2, 675	3, 484	3, 888	2, 395	4, 106
Stone:						
Granite..........tons	6, 853	13, 572	4, 431	554	35, 707	69, 619
Limestone..........do	31, 772	77, 055	75, 072	61, 955	65, 634	159, 646
Marble..........do					145	119
Sandstone..........do	2, 642	2, 018	4, 244	3, 217	8, 435	10, 751
ONTARIO						
Abrasives:						
Garnets..........tons	327					
Grinding pebbles..........do	(3)	95	58			
Actinolite..........do	82	36	73	78	64	27
Antimony, metallic [9] ....kilograms		794	724			
Arsenic, white..........tons	1, 699	978	1, 840	2, 250	1, 858	1, 698
Asbestos..........do	156	2	13			
Beryl crystals.....kilograms						2, 021
Bismuth, metallic [10]..........do	5, 835	8, 921	2, 921	919	6, 351	12, 449
Cement..........tons	565, 887	549, 672	539, 591	595, 620	621, 023	734, 203
Cobalt [11]..........kilograms	430, 323	506, 430	301, 537	399, 427	433, 900	421, 573
Coke [1]..........tons	777, 932	753, 721	1, 038, 261	1, 143, 369	1, 309, 525	1, 474, 062
Copper:						
Metallic copper ....kilograms	16, 834, 173	18, 016, 040	18, 739, 103	20, 566, 358	30, 212, 501	40, 315, 013
Copper sulphate..........do	(2)	(2)				

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[1] Metallurgical and gas-house coke, including breeze.
[2] Ontario included with British Columbia.
[3] Data not available.
[5] Nova Scotia and Quebec included with New Brunswick.
[6] Nova Scotia included with New Brunswick.
[7] Bog ore.
[8] Exclusive of ferro-alloys, which are not reported by Provinces.
[9] See footnote 4 under Dominion of Canada.
[10] See footnote 8 under Dominion of Canada.
[11] See footnote 10 under Dominion of Canada.

Mineral production of Canada, 1924–1929, by Provinces—Continued

Province and mineral	1924	1925	1926	1927	1928	1929
ONTARIO—continued						
Feldspar ... tons	25,997	15,780	20,668	15,530	17,195	19,719
Fluorspar ... do	70	11	...	...	...	63
Gold, fine ... grams	38,622,063	45,443,399	46,568,598	50,606,919	49,094,792	50,458,151
Graphite ... tons	1,168	2,005	2,178	1,628	950	1,168
Gypsum:						
Crude, mined ... do	89,198	(3)	(3)	(3)	(3)	(3)
Shipments, crude or calcined ... tons	79,942	74,407	81,634	76,201	77,846	91,033
Iron:						
Ore ... do	40	...	...	...	...	...
Pig iron[8] ... do	422,647	374,893	515,218	467,534	746,572	781,707
Lead, metallic ... kilograms	2,293,064	3,270,172	3,356,019	3,624,506	3,091,106	2,163,400
Lime:						
Hydrated ... tons	32,648	37,748	35,577	40,596	44,529	50,725
Quicklime ... do	139,422	162,439	171,529	179,969	206,928	285,075
Mica ... do	2,190	1,456	799	1,165	2,321	2,714
Natural gas ... cubic meters	202,468,759	202,295,572	219,881,392	207,031,675	216,137,998	243,143,213
Nickel:						
Ores, mined[12] ... tons	1,280,920	1,147,354	1,199,337	1,184,702	1,322,587	1,807,021
Nickel, metallic[13] ... kilograms	31,540,993	33,500,848	29,807,347	30,299,230	43,887,363	50,020,051
Peat ... tons	...	1,243	...	...	1,358	2,365
Petroleum, crude ... hectoliters	245,485	227,620	219,217	222,010	213,244	192,730
Phosphate rock (apatite) ... tons	...	...	...	74	...	...
Platinum metals:						
Palladium, rhodium, etc. ... grams	295,981	257,786	311,781	359,090	423,225	533,145
Platinum, from mattes, etc ... grams	285,561	270,351	294,581	348,888	325,094	387,985
Pyrite ... tons	10,368	622	337	420	421	614
Quartz (silica) ... do	101,282	171,058	174,843	144,378	176,449	170,525
Salt (shipments) ... do	184,546	205,308	228,922	230,588	253,838	274,372
Sand and gravel ... do	5,600,570	4,718,791	5,881,395	6,815,428	9,425,063	10,304,266
Silver, fine ... kilograms	350,616	327,493	288,484	289,510	225,270	276,532
Stone:						
Granite ... tons	194,763	239,103	361,287	354,416	549,093	771,944
Limestone ... do	2,372,195	2,494,849	2,916,170	3,496,654	3,598,872	3,974,089
Marble ... do	...	...	532	...	...	...
Sandstone ... do	9,590	8,192	7,855	8,945	8,669	7,293
Talc and soapstone ... do	9,723	12,409	13,501	13,733	[4] 13,540	[4] 14,028
Zinc, metallic ... kilograms	...	81,440	...	...	26,637	2,502,368
QUEBEC						
Asbestos ... tons	150,612	248,134	253,456	249,273	247,690	277,647
Cement ... do	437,901	534,343	591,745	736,114	780,101	820,677
Clay: Kaolin ... do	...	...	...	22	5	...
Coke[1] ... do	(5)	179,352	147,116	131,122	217,908	318,758
Copper, metallic ... kilograms	858,649	1,138,575	1,212,926	1,415,132	15,285,053	25,100,386
Feldspar ... tons	14,648	10,239	11,946	11,548	11,741	14,325
Gold, fine ... grams	27,464	49,828	114,461	259,123	1,866,396	2,824,134
Graphite ... tons	42	326	296	31	45	157
Ilmenite ... do	1,277	3,609	181	1,841	2,036	2,493
Iron oxide ... do	6,483	6,337	5,913	5,380	4,788	5,643
Lead, metallic ... kilograms	480,344	930,358	1,691,726	2,946,782	2,820,575	2,430,473
Lime:						
Hydrated ... tons	5,305	8,557	10,815	9,594	10,225	8,598
Quicklime ... do	70,467	72,163	79,664	88,067	93,311	142,283
Magnesite:						
Crude, mined ... do	9,512	3,827	11,429	18,523	33,311	39,216
Shipments—						
Crude ... do	...	1,367	...	...	...	...
Calcined ... do	1,393	3,691	4,147	6,656	11,970	17,063
Dead burned ... do	2,121					
Mica ... do	1,521	2,191	1,510	1,319	999	963
Molybdenite:						
Concentrates ... do	9	14	12	...	...	9
Content MoS_2 ... kilograms	8,500	10,138	9,500	...	...	7,325
Phosphate rock (apatite) tons	...	15	36	28	83	36
Pyrite ... do	3,658	11,113	12,791	11,812	3,982	18,312
Quartz (silica) ... do	16,232	5,859	22,271	44,580	58,583	42,133
Sand and gravel ... do	1,992,986	1,998,695	4,747,905	7,816,025	7,381,126	5,627,447
Silver, fine ... kilograms	2,607	6,685	11,694	23,043	28,272	25,313

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[1] Metallurgical and gas-house coke, including breeze.

[3] Data not available.

[4] Talc only.

[5] Nova Scotia and Quebec included with New Brunswick.

[8] Exclusive of ferro-alloys, which are not reported by Provinces.

[12] See footnote 20 under Dominion of Canada.

[13] See footnote 21 under Dominion of Canada.

Mineral production of Canada, 1924–1929, by Provinces—Continued

Province and mineral	1924	1925	1926	1927	1928	1929
QUEBEC—continued						
Stone:						
Granite……tons	38, 358	446, 320	448, 496	147, 127	209, 250	461, 275
Limestone……do	1, 329, 234	1, 521, 807	1, 618. 803	2, 042, 515	2, 435, 148	2, 565, 269
Marble……do	4, 299	2, 763	4, 272	4, 181	6, 026	11, 867
Sandstone……do	72, 747	63, 838	20, 145	105, 454	64, 033	122, 632
Talc and soapstone……do	407	639	803	1, 158	1, 027	([14])
Zinc, metallic……kilograms	1, 319, 497	4, 506, 870	5, 853, 205	7, 796, 779	9, 551, 589	8, 914, 604
SASKATCHEWAN						
Abrasives: Pumice (volcanic ash)……tons	222	145	82	95	440	272
Clay, fire clay……do	286	289	733	914	1, 204	684
Coal, lignite, mined……do	434, 646	428, 157	398, 981	426, 570	427, 928	526, 336
Sand and gravel……do	637, 417	526, 075	783, 714	1, 376, 919	2, 018, 951	3, 172, 117
Sodium sulphate:						
Crude……do	875	3, 516	6, 146	5, 134	5, 458	4, 552
Refined……do	107	------	------	------	------	------
YUKON						
Coal, bituminous, mined……tons	1, 017	662	286	376	375	415
Copper, metallic……kilograms	------	------	------	------	48, 705	------
Gold, fine……grams	1, 083, 179	1, 487, 275	796, 280	962, 186	1, 068, 840	1, 116, 366
Lead, metallic……kilograms	409, 828	850, 682	2, 658, 207	1, 889, 353	3, 261, 969	3, 808. 162
Silver, fine……do	7, 053	28, 145	65, 163	51, 237	88, 323	102, 005

[14] Soapstone only. Quantity not stated; value $47,986.

CEYLON

Mineral production of Ceylon, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Gems [2]	([2])	([2])	([2])	([2])	([2])	([2])
Graphite……tons	9, 806	15, 674	11, 810	13, 091	14, 576	12, 942
Mica……kilograms	------	1, 118	------	------	------	610
Monazite sand……tons	29	159	------	------	87	------
Salt [3]……do	9, 412	20, 588	16, 218	26, 080	44, 275	25, 482

[1] Source of data: Ceylon Blue Book and information furnished by the Inspector of Mines and the Salt Adviser, Ceylon, through the American consulate, Colombo. The data relate to exports, except as otherwise stated.

[2] Sapphires, rubies, and gem corundum are mined in Ceylon. Accurate data of the production and exports of gems are not available, but the value of the annual output may be roughly estimated at about 5,000,000 rupees. (M. M. Vance, American consul, Colombo, 1921.) The legal value of the rupee is 1s. 4d., or 15 rupees to the pound sterling.

[3] Production.

CHILE

Mineral production of Chile, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Borates ..... tons	32,427	39,662	34,668	20,300	18,934	.....
Cement ..... do	(2)	(2)	(2)	95,853	110,721	145,234
Clay:						
Kaolin ..... do	500	580	352	352	.....	.....
Other clay ..... do	3,031	2,273	3,325	3,788	8,148	9,611
Coal ..... do	1,539,141	1,453,228	1,490,509	1,481,511	1,375,616	1,507,866
Cobalt ore and concentrates [3] ..... kilograms	34,588	.....	6,400	2,991	10,543	.....
Coke, gas house ..... tons	(2)	(2)	(2)	53,478	50,464	50,902
Coke by-products: Tar ..... liters	(2)	(2)	(2)	4,518,032	5,088,250	5,523,017
Copper:						
Ore [4] ..... tons	10,586,922	11,922,493	12,751,735	14,718,068	18,802,688	21,368,957
Bars ..... kilograms	174,798,547	177,082,320	188,875,240	226,160,499	274,897,090	303,187,612
Gold, fine ..... grams	3,483,971	3,293,025	3,595,557	975,589	958,081	806,257
Gypsum ..... tons	5,691	8,446	6,991	8,245	9,113	15,434
Iodine ..... kilograms	591,396	998,705	906,086	778,599	994,520	1,386,995
Iron ore [5] ..... tons	1,049,860	1,234,094	1,396,406	1,508,286	1,524,776	1,812,432
Lead ore and concentrates [6] ..... tons	2,762	6,984	8,516	[7] 6,206	[7] 3,313	3,142
Lime and limestone ..... do	42,667	134,246	133,882	137,439	186,222	219,999
Manganese ore [8] ..... do	4,243	11,062	[9] 11,134	[9] 7,688	[9] 9,192	[9] 3,104
Mineral paint ores ..... do	.....	.....	.....	3	100	.....
Molybdenite ..... kilograms	.....	.....	208	[10] 1,478	.....	.....
Nitrate of soda ..... tons	2,406,041	2,523,936	2,016,429	1,614,082	3,162,521	3,233,321
Potash, perchlorate of [11] ..... kilograms	.....	85,550	120,943	101,215	296,800	1,258,600
Salt ..... tons	36,093	29,334	34,903	71,549	34,746	37,422
Silver, fine ..... kilograms	94,346	101,453	101,135	46,804	44,936	48,843
Stone: Marble ..... tons	.....	.....	.....	.....	.....	1,000
Sulphur ..... do	9,765	9,072	8,928	12,500	15,670	16,300
Zinc ore and concentrates [12] ..... tons	.....	258	1,257	2,360	1,237	96
Zinclead ore [13] ..... do	.....	.....	57	222	26	.....

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[1] Source of data: Estadística anual: Mineria é Industria; Anuario Estadístico de la República de Chile, vol. 8 Minería y Metalurgia; data supplied by the Am. commercial attaché, Santiago de Chile.

[2] Data not available.

[3] Average cobalt content reported as follows: 1924, 6 per cent; 1926, 15 per cent; 1927, 15.75 per cent; 1928, 15.78 per cent.

[4] Average copper content reported as follows: 1924, 2.02 per cent; 1925, 2.04 per cent; 1926, 1.91 per cent; 1927, 1.98 per cent; 1928, 2.27 per cent; 1929, 1.82 per cent.

[5] Figures as reported by the Chilean Government. Production of the Tofo iron mine is reported by the operator as follows: 1924, 987,969 tons; 1925, 1,350,834 tons, 1926, 1,476,355 tons; 1927, 1,516,440 tons; 1928, 1,515,203 tons; 1929, 1,812,343 tons.

[6] Average lead content reported as follows: 1924, 47.6 per cent; 1925, 30.24 per cent; 1926, 32.60 per cent, 1927, 39.71 per cent; 1928, 43.26 per cent; 1929, 52.22 per cent.

[7] Includes some copper-lead-silver ore, which is also included under copper ore.

[8] Average manganese content reported as follows: 1924, 50 per cent; 1925, 47.35 per cent; 1926, 49.51 per cent; 1927, 49.92 per cent; 1928, 47.35 per cent; 1929, 47.11 per cent.

[9] Exports.

[10] Average content of MoS_2 reported as 94.99 per cent.

[11] Produced in the nitrate plants from caliche.

[12] Average zinc content reported as follows. 1925, 35 per cent; 1926, 34.95 per cent; 1927, 39.84 per cent, 1928, 39.70 per cent; 1929, 40 per cent.

[13] Average content reported as follows: 1926, zinc 25 per cent, lead 25 per cent; 1927, zinc 28.33 per cent, lead 22.28 per cent; 1928, zinc 30.36 per cent, lead 20.43 per cent.

CHINA

The only official mineral statistics published annually in China are those issued by the Maritime Customs, covering imports and exports.

In recent years the Geological Survey of China has issued two special reports on the mining industry of the country. One, published in 1926, covers the estimated mineral output in 1925; the other, published in 1929, gives similar data for 1927.

In the statistics given below the first table shows the minerals of domestic origin exported from China, 1924–1929, inclusive, except as otherwise noted; the second gives the estimated mineral production of the country in 1925 and 1927.

Minerals exported from China, 1924–1929 [1]

[Domestic production]

Mineral	1924	1925	1926	1927	1928	1929
Alum, white............tons..	4, 795	6, 262	2, 107	2. 364	2, 427	3, 159
Antimony:						
Ore.................do....	570	2, 087	2, 293	1, 938	2, 408	....
Crude antimony....do....	1, 892	2, 746	3, 238	2, 342	3, 178	3, 896
Regulus.............do....	10, 696	17, 013	18, 085	15. 806	16, 455	20, 063
Arsenic:						
Realgar.............do....	472	395	(2)	(2)	(2)	(2)
White arsenic.......do....	237	94	(2)	(2)	(2)	(2)
Asbestos [3]..............do....	127	216	(2)	(2)	(2)	(2)
Cement..................do....	24, 660	24, 012	28, 087	30, 388	63. 359	184, 698
Coal [4]....................do....	[5] 3, 253, 750	[5] 3, 051, 021	[5] 3, 134, 232	[5] 4, 078, 452	[5] 3, 947. 616	[5] 4, 189, 860
Coke.....................do....	27, 606	19, 217	14, 551	12, 989	14, 211	13, 467
Copper (ingots and slabs) ....kilograms..	841, 742	1, 048, 156	2, 068, 249	1, 052, 087	4, 395, 347	3, 469, 298
Gold, fine [6]..............do....	3, 337	3, 338	3, 421	3. 110	3, 110	1, 555
Gypsum.................tons..	5, 123	7, 097	3, 781	2, 470	3, 266	3, 148
Iron:						
Ore.................do....	853, 589	822, 422	525, 426	501, 889	924, 988	979, 744
Pig iron.............do....	265, 468	159, 963	171, 468	204, 135	220, 539	205, 470
Lead:						
Ore.................do....	7, 232	11, 034	13, 474	5, 109	4, 825	5, 213
Metal (pigs and bars) ....kilograms .	1, 134, 035	398, 494	153, 616	137, 528	16, 813	16, 995
Oxides..............tons..	54	37	....	....	....	....
Manganese ore...........do....	38, 538	43, 260	42, 460	46, 350	43, 332	41, 881
Mercury, metallic [3].....do....	3	3	2	(2)	(2)	(2)
Potash...................do....	[7] 587	[7] 336	(2)	(2)	(2)	(2)
Salt.....................do....	202, 031	177, 407	205, 726	302, 836	318, 228	393, 944
Silver, fine [6].......kilograms..	3, 421	3, 421	4, 199	3, 111	3, 111	1, 555
Soda.....................tons.	611	344	(2)	(2)	(2)	(2)
Tin:						
Ingots and slabs....do....	7, 097	9, 026	6, 613	6, 320	7, 145	6, 887
Tin foil.............do....	67	47	21	22	33	19
Tin and lead foil....do....	....	....	....	18	27	....
Tungsten ore: Wolfram.do....	3, 044	5, 963	7, 101	5, 036	7, 363	8, 869
Zinc:						
Ore.................do....	20, 456	34, 747	24, 791	5, 388	8, 297	22, 561
Crude zinc....kilograms..	212, 099	247, 116	[3] 179, 840	(2)	(2)	(2)

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[1] Source of data: Foreign Trade of China, Maritime Customs, part 2, except as otherwise noted.

[2] Data not available.

[3] Figures as published by the Imp. Inst., London.

[4] Production as estimated by the Geological Survey of China is as follows: 1924, 25,780,875 tons; 1925, 24,255,042 tons; 1926, 23,040,119 tons; 1927, 24,172,009 tons; 1928, 25,091,760 tons; 1929, data not available.

[5] Includes bunker coal.

[6] Production. Figures as published by the Director, U. S. Mint.

[7] Estimated equivalent in K_2O as follows: 1924, 235 tons; 1935, 134 tons. (Imp. Inst., London.)

Estimated mineral production of China, 1925 and 1927 [1]

Mineral	1925	1927	Mineral	1925	1927
Abrasives.........tons..	2,583	2,560	Lime...............tons..	85,000	110,000
Alum...............do....	[2] 11,022	7,200	Magnesite..........do....	13,773	21,400
Antimony:			Manganese ore......do....	[2] 43,439	71,331
Ore...............do....	[2] 2,181	20,013	Mercury, metallic..do....	470	74
Crude antimony ....do....	[2] 2,954		Molybdenum ore...do....	([4])	([4])
Regulus...........do....	[2] 16,132		Petroleum....hectoliters..	1,876	1,510
Arsenic oxide.......do....	[2] 1,547	1,580	Phosphate rock.....tons..	13,400	12,000
Asbestos............do....	213	241	Potash (saltpeter)..do....	5,600	5,200
Bismuth ore.........do....	60	240	Salt...............do....	3,639,000	2,067,269
Cement..............do....	428,543	([3])	Silver.........kilograms..	1,475	1,878
Clay (kaolin).......do....	88,196	105,023	Soda, natural......tons..	61,500	72,500
Coal:			Stone:		
Anthracite.....do....	3,733,579	2,970,332	Building stone [5]......	($1,020,218)	($801,561)
Bituminous.....do....	20,277,949	20,919,227	Dolomite.......tons..	46,500	77,000
Lignite.........do....	243,514	282,450	Sulphur.............do....	2,348	2,521
Coke................do....	695,535	500,000	Talc [6].............do....	31,516	23,000
Fluorspar...........do....	4,498	3,436	Tin, metallic.......do....	9,354	9,531
Gold..............grams..	61,958,134	42,148,638	Tungsten ore........do....	[2] 5,282	8,366
Gypsum.............tons..	67,000	45,220	Zinc:		
Iron:			Ore.............do....	39,223	16,314
Ore...............do....	1,519,021	1,710,135	Crude zinc.....do....	[7] 1,109	([3])
Pig iron..........do....	369,617	411,148			
Lead:					
Ore...............do....	10,097	6,124			
Metal (smelter product).....do....	1,505	([3])			

[1] Source of data: General Statement on the Mining Industry, China Geol. Surv., Special Repts. Nos. 2 and 3. Peiping, 1926 and 1929.

[2] Reported as "Original exports."

[3] Production not stated.

[4] Small production reported, but figures not given.

[5] Value only reported. Values converted from Chinese dollars at the annual average rates of exchange, as published by the U. S. Federal Reserve Board.

[6] Soapstone is also produced in China, but no figures of production are reported.

[7] Output for 1925 is estimated commercially to be about 300 tons.

COLOMBIA

Deposits [14] of antimony, arsenic, asphalt, barite, coal, copper, emeralds, gold, graphite, gypsum, iron, kaolin, lead, manganese, marble, mercury, mica, nitrate, petroleum, platinum, salt, silver, sulphur, talc, tin, titanium, and zinc are known in Colombia; but only coal, emeralds, gold, iron ore, mercury, petroleum, salt, and silver are reported to be under exploitation.

Colombia takes high rank as a world source of platinum and emeralds, ranking second only to Russia as a producer of crude platinum and holding almost a monopoly in the emerald trade. The petroleum industry of the country is growing steadily in importance, and Colombia now stands eighth in the list of world producers.

The output of gold, petroleum, platinum, salt, and silver, the only minerals for which production figures are available, is reported as follows:

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[14] Bürger, O. Kolumbien, ein Betätigungsfeld für Handel und Industrie: Leipzig, 1922, 383 pp.

Codazzi, R. Ll., Los minerales de Colombia: Bogotá, 1927, 150 pp.

Irisarri, A. M., Mineral Resources of Colombia: Pan-Am. Geol., vol. 52, No. 4, Des Moines, 1929, pp. 267-274.

Stutzer, O., Ein Überblick über die wichtigsten Bodenschätze Kolumbiens: Internat. Bergwirt., Jahrg 2, No. 8, Leipzig, 1927, pp. 145-150.

Gold, petroleum, platinum, salt, and silver produced in Colombia, 1924–1929

Mineral	1924	1925	1926	1927	1928	1929
Gold, fine [1] grams	3, 009, 000	2, 381, 000	2, 229, 000	2, 257, 000	1, 254, 000	1, 505, 000
Petroleum [2] hectoliters	707, 072	1, 600, 505	10, 244, 272	23, 870, 611	31, 632, 724	32, 408, 168
Platinum grams	[3] 1, 431, 000	[3] 1, 400, 000	[4] 1, 386, 127	[4] 1, 425, 473	[4] 1, 665, 000	[4] 1, 417, 603
Salt [5] tons	29, 000	29, 000	29, 000	29, 000	29, 000	29, 000
Silver, fine [1] kilograms	90	90	3, 918	4, 088	2, 122	1, 866

[1] Figures of production as published by the Director, U. S. Mint.
[2] Colombia, Ministerio de Industrias, Bol. de Minas y Petróleo.
[3] Approximate production.
[4] Figures based on data supplied by South American Gold & Platinum Co.
[5] Approximate annual output.

COSTA RICA

Deposits of asphalt, coal, copper, gold, iron, manganese, petroleum, silver, sulphur, and titanium are reported in Costa Rica.[15] The precious metals have been mined and exported for many years, and salt is produced from sea water on the Pacific coast by evaporation. The manganese deposits were developed during the World War; but the mines were closed in 1920, and operations have not been resumed. Prospecting for petroleum to date has not resulted in production on a commercial scale. Sulphur of good quality is found in the volcanic region of the northwest, from Mount Gongora to Mount Miravalles. Titanium occurs in the beach sands near Port Limón.

Exports of gold bullion are reported as follows for the years 1926 to 1929, inclusive: 1926, 1,315,086 grams; 1927, 1,602,800 grams; 1928, 1,173,510 grams; 1929, 100,700 grams.

CUBA

Mineral production of Cuba, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt tons	3, 643	2, 814	7, 988	4, 116	13, 186	10, 695
Chromite [b] do	8, 276	30, 309	36, 598	17, 256	34, 248	53, 799
Copper ore do	210, 559	212, 011	245, 578	283, 696	367, 723	([c])
Gypsum do	([c])	([c])	([c])	([c])	23, 950	25, 400
Iron ore [d] do	299, 283	567, 126	587, 369	421, 505	400, 750	682, 095
Manganese ore do	25, 310	51, 638	28, 091	812	2, 440	972
Petroleum hectoliters	6, 164	5, 566	3, 067	4, 069	7, 192	3, 065
Salt (sea salt) tons	([c])	([c])	([c])	411	2, 359	14, 515
Stone:						
Limestone do	([c])	([c])	11, 380	[e] 12, 700	32, 595	36, 000
Marble do	([c])	500	([c])	2, 400	1, 000	1, 500

[a] Source of data: Boletin de Minas, Dirección de Montes y Minas, Cuba; information furnished by the American consulate, Habana; and other sources as noted.
[b] Imports into the United States (U. S. Dept. Commerce).
[c] Data not available.
[d] Shipments reported by operator.
[e] Exports.

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[15] Information supplied by the American consulates at San Jose and Port Limón, Costa Rica.

CYPRUS

Mineral production of Cyprus, 1924–1929, in tons [1] [2]

Mineral	1924	1925	1926	1927	1928	1929
Asbestos……tons	3, 898	3, 343	6, 433	11, 079	11, 765	14, 017
Chromite……do	2, 856	2, 021	[3] 524	[3] 711		[3] 842
Copper:						
Ore……kilograms			102			
Precipitate……do				10, 160	10, 160	54, 867
Gypsum:						
Crude……tons		71	1, 292	1, 383	384	342
Calcined……do	14, 525	24, 510	19, 445	14, 010	11, 225	12, 415
Magnesite……do	224		83	16		
Manganese ore……do				[4] 16		
Mineral paint ores: Umber……do	4, 909	6, 065	5, 147	5, 655	5, 884	6, 693
Pyrite (cupreous-iron)……do	130, 245	176, 036	152, 776	211, 462	243, 913	295, 772
Salt (sea salt) [5]……do	3, 000	3, 000	3, 000	3, 000	3, 000	3, 000
Terre verte……do		1	4	16	6	13

[1] Source of data: Publications of the Imp. Inst., London; information supplied by the American consulate, Port Said, Egypt.

[2] Figures represent exports, except as otherwise noted.

[3] Shipments are reported as follows: 1926, 650 tons; 1927, 723 tons; 1928, none; 1929, 2,483 tons.

[4] Production.

[5] Approximate production.

CZECHOSLOVAKIA

Mineral production of Czechoslovakia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony:						
Ore [2]……tons	4, 422	4, 172	7, 319	14, 318	11, 607	6, 203
Regulus……do	347	691	1, 051	1, 024	795	400
Asphalt rock……do					586	1, 783
Bismuth:						
Ore……do	134					
Metal (smelter product)……kilograms	(3)	555				
Briquets:						
Coal……tons	75, 710	156, 477	181, 797	160, 254	214, 613	270, 294
Lignite……do	175, 613	211, 884	197, 211	211, 770	241, 174	256, 111
Coal:						
Bituminous……do	15, 178, 942	12, 558, 992	14, 176, 998	14, 016, 300	14, 560, 305	16, 521, 457
Lignite……do	20, 459, 690	18, 604, 678	18, 515, 666	19, 620, 637	20, 451, 421	22, 560, 796
Coke:						
Coal……do	2, 218, 375	2, 009, 442	1, 957, 213	2, 423, 081	2, 815, 973	3, 163, 194
Lignite……do	2, 181	6, 526	4, 549	5, 503	5, 450	7, 435
Copper:						
Ore [4]……do	590	3, 606	16, 699	44, 459	52, 312	55, 564
Blister……kilograms		458, 000	370, 000	344, 000	533, 000	1, 026, 000
Cement……tons	2, 110	2, 203	2, 418	2, 549	3, 224	3, 781
Electrolytic……kilograms	301, 100	34, 000	348, 000	399, 000	477, 000	668, 000
Matte……tons		174	63	250	133	182
Slimes, anodic……do	23	8	10	19	8	57
Feldspar [5]……do	30, 000	30, 000	30, 000	30, 000	30, 000	30, 000
Gold ore……do	34, 007	31, 846	31, 135	31, 442	27, 321	27, 920
Gold, fine [6]……grams	280, 271	237, 775	240, 480	231, 000	220, 535	156, 334
Graphite……tons	11, 935	18, 466	30, 818	41, 113	32, 332	23, 671
Iron:						
Ore……do	1, 173, 935	1, 229, 954	1, 421, 174	1, 590, 527	1, 779, 176	1, 807, 663
Pig iron [7]……do	983, 042	1, 166, 422	1, 087, 984	1, 260, 363	1, 569, 204	1, 644, 515
Kaolin [5]……do	500, 000	500, 000	500, 000	500, 000	500, 000	500, 000
Lead-zinc-silver ore [8]……do	(9)	71, 302	85, 646	102, 146	87, 781	116, 645
Lead:						
Concentrates……do	849	11, 876	11, 746	12, 916	13, 857	14, 591
Antimonial lead……kilograms	193, 100	330, 000	312, 000	173, 000	563, 000	1, 296, 000
Soft lead……do	2, 071, 200	1, 871, 000	1, 990, 000	1, 956, 000	2, 369, 000	3, 171, 000
Zincky lead……tons		11	14	73	133	142

[1] Source of data: Zprávy Státního Úřadu Statistického Republiky Československé, Prague, except as otherwise noted.

[2] Average antimony content reported as follows: 1925, 14.07 per cent; 1926, 16.03 per cent; 1927, 13.84 per cent; 1928, 10.41 per cent; 1929, 11.20 per cent. Content not reported for 1924.

[3] Data not available.

[4] Average content reported as follows: 1925, Cu, 4.80 per cent; 1926, Cu, 3.63 per cent, Ag, 180 grams per ton; 1927, Cu, 2.61 per cent, Ag, 180 grams per ton; 1928, Cu, 3.11 per cent, Ag, 180 grams per ton; 1929, Cu, 2.45 per cent, Ag, 180 grams per ton. Similar data not available for 1924.

[5] Estimated average annual output. (Statistical Committee, Czechoslovak Ceramic Society.)

[6] Estimated content of ores and bullion produced.

[7] Includes ferro-alloys.

[8] Metallic content reported as follows: 1925, lead, 2,850 tons, zinc, 532 tons, gold, 1,987 grams, silver, 22,811 kilograms; 1926, lead, 3,857 tons, zinc, 268 tons, gold, 619 grams, silver, 22,454 kilograms; 1927, lead, 4,035 tons, zinc, 848 tons, silver, 24,333 kilograms; 1928, lead, 4,142 tons, zinc, 528 tons, silver, 24,775 kilograms; 1929, lead, 4,482 tons, zinc, 8 tons, gold, 69,388 grams, silver, 30,499 kilograms.

[9] Data not available. Production of silver ore reported as 15,581 tons; average content not stated.

Mineral production of Czechoslovakia, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Litharge tons	152	157	129	135	91	76
Lithium minerals do	------	33	24	47	------	------
Magnesite:						
Crude [10] do	4, 814	7, 212	12, 573	11, 735	8, 411	10, 188
Calcined [10] do	26, 300	29, 676	33, 601	34, 680	37, 612	43, 300
Manganiferous iron ore [11] do	79, 133	77, 980	95, 173	108, 376	99, 438	96, 529
Mercury:						
Ore [12] do	40	785	734	149	496	519
Metal kilograms	77, 800	73, 416	82, 277	55, 247	71, 929	65, 445
Natural gas cubic meters	507, 359	412, 518	325, 969	273, 488	281, 440	1, 700, 192
Petroleum, crude tons	11, 157	23, 352	22, 138	16, 474	13, 929	13, 864
Pyrites:						
Arsenical [13] do	217	34	4	13	6	38
Iron do	15, 935	21, 594	22, 512	23, 300	23, 626	23, 005
Quartz [5] do	20, 000	20, 000	20, 000	20, 000	20, 000	20, 000
Salt do	124, 773	76, 826	98, 105	122, 202	154, 243	166, 361
Sand, for china and glass making [5] do	450, 000	450, 000	450, 000	450, 000	450, 000	450, 000
Silver, fine [6] kilograms	22, 785	22, 245	23, 810	23, 780	23, 881	22, 488
Tin-tungsten ore [14] tons	(15)	5, 292	7, 560	8, 115	7, 984	8, 547
Uranium:						
Ore do	[16] 28	103	213	212	316	228
Radium salts [17] milligrams	3, 052	5, 934	------	6, 446	9, 260	11, 357
Uranium pigments kilograms	10, 928	10, 105	15, 824	21, 116	21, 242	23, 347
Zinc:						
Concentrates tons	690	1, 057	540	856	559	------
Crude zinc kilograms	6, 896, 600	1, 273, 000	1, 051, 000	125, 000	------	1, 167, 000
Refined zinc tons	------	1, 769	1, 738	6, 199	8, 039	9, 508

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[5] Estimated average annual output. (Statistical Committee, Czechoslovak Cermic Society.)

[6] Estimated content of ores and bullion produced.

[10] Exports less imports. (Imp. Inst., London.)

[11] Average content of manganese reported as follows: 1925, 17.24 per cent; 1926, 16.82 per cent; 1927, 16.56 per cent; 1928, 16.99 per cent; 1929, 17.37 per cent. Similar data not available for 1924.

[12] Average content of mercury reported as follows: 1925, 1.67 per cent; 1926, 1.31 per cent; 1927, 1.17 per cent; 1928, 1.13 per cent; 1929, 1.24 per cent. Similar data not available for 1924.

[13] Average content of arsenic and bismuth reported as follows: 1925, arsenic, 12 to 20 per cent; 1926 and 1927, arsenic, 25 per cent; 1928 and 1929, arsenic, 20 per cent, bismuth, 10 per cent. Similar data not available for 1924.

[14] Average content reported as follows: 1925, WO_3, 0.51 per cent, Sn, 0.34 per cent, Pb, 0.01 per cent; 1926, WO_3, 0.67 per cent; Sn, 0.29 per cent, Pb, 0.01 per cent; 1927, WO_3, 0.58 per cent, Sn, 0.40 per cent, Pb, 0.01 per cent; 1928, WO_3, 0.55 per cent, Sn, 0.34 per cent, Pb, 0.01 per cent; 1929, WO_3, 0.53 per cent, Sn, 0.29 per cent, Pb, 0.004 per cent.

[15] Figures for output of ore not available, production of 66 tons of 60 per cent tungsten concentrates reported.

[16] Concentrates.

[17] Contained radium element reported as follows in milligrams: 1924, 1,433; 1925, 1,378; 1927, 2,031; 1928, 3,318; 1929, 3,521.

DENMARK

Mineral production of Denmark, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Cement, Portland	681, 921	590, 771	569, 021	642, 634	779, 339	799, 456
Chalk:						
Crude	26, 654	23, 484	18, 685	17, 454	18, 549	23, 983
Washed	13, 899	14, 697	12, 632	10, 342	10, 944	14, 667
Clay, kaolin	(2)	23, 782	4, 625	15, 414	40, 300	21, 683
Coal, lignite [3]	(3)	(3)	(3)	(3)	(3)	(3)
Flint:						
Pebbles	25, 570	18, 352	13, 008	11, 108	9, 565	6, 987
Other flint	13, 005	11, 034	15, 919	17, 300	16, 948	13, 883
Lime	55, 689	54, 721	58, 931	49, 122	58, 108	59, 522
Marls for fertilizer:						
Crude	109, 000	(2)	(2)	25, 693	53, 023	37, 588
Crushed				44, 479	50, 131	93, 452
Peat [4]	(4)	(4)	(4)	(4)	(4)	245, 000
Stone:						
Granite	(2)	28, 126	111, 613	102, 438	102, 724	115, 829
Limestone—						
For building	(2)	2, 071	1, 215	3, 835	2, 286	5, 042
For industrial uses [5]	143, 902	134, 741	109, 258	129, 284	100, 165	97, 748
Sandstone	(2)	(2)	930	577	805	799

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[1] Source of data: Information furnished by the Statistiske Departement, Copenhagen, through the American consul general, Copenhagen.

[2] Data not available.

[3] A small quantity of lignite is produced for local use, but the amount is unknown.

[4] Considerable quantities of peat produced, but no statistics of output available prior to 1930. Production and consumption are confined almost entirely to private individuals, mainly farmers.

[5] Reported in cubic meters which have been converted to tons on the basis of 2.7 tons to the cubic meter.

DOMINICAN REPUBLIC

Mineral industry from a commercial standpoint is practically nonexistent in the Dominican Republic.[16] Occurrences of amber, coal (lignite), copper, gold, gypsum, iron, lead, manganese, nickel, petroleum and salt are reported,[17] but few of them are important. Search for petroleum has not resulted in commercial production.

ECUADOR

The chief mineral products of Ecuador are gold, petroleum, salt, silver, and sulphur. Coal and manganese have been mined but not on a commercially important scale. Deposits of barite, copper, graphite, gypsum, iron, kaolin, lead, limestone, marble, and mica have also been reported,[18] but they remain virtually undeveloped.

The only mineral statistics relate to gold, petroleum, salt, silver, and sulphur and are as follows:

Mineral production of Ecuador, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Gold, fine [2] ....grams..	1, 204, 000	1, 354, 000	1, 944, 000	1, 998, 000	2, 319, 000	2, 094, 000
Petroleum ....hectoliters..	[3] 160, 000	254, 559	339, 467	854, 440	1, 722, 871	2, 196, 262
Salt:						
Rock salt ....tons..	(4)	11, 047	8, 587	628	333	60
Other salt ....do....				16, 100	10, 051	17, 377
Silver, fine [2] ....kilograms..	2, 177	2, 177	2, 488	2, 725	2, 482	3, 002
Sulphur ....do....	(4)	(4)	(4)	(4)	161, 000	59, 800

[1] Information supplied by American consulate, Guayaquil, except as otherwise noted.
[2] Figures as published by Director, U. S. Mint.
[3] Approximate production.
[4] Data not available.

EGYPT

Mineral production of Egypt, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Clay ....tons..	1, 518	1, 369	2, 400	2, 034	2, 023	(b)
Gold, fine ....grams..	29, 051	11, 259	20, 435	1, 897	----------	----------
Gravel ....cubic meters..	(b)	(b)	(b)	(b)	350, 000	(b)
Gypsum [c] ....do....	(b)	(b)	130, 000	130, 000	130, 000	130, 000
Lead ore ....tons..	----------	----------	----------	160	----------	350
Manganese ore ....do....	150, 194	80, 589	121, 868	152, 845	137, 502	191, 477
Mineral paint ores (ocher, etc.) do....	45	65	818	1, 252	944	1, 017
Nitrate shale [d] ....do....	1, 582	1, 143	455	460	614	955
Petroleum, crude ....do....	163, 341	179, 651	172, 952	184, 556	268, 323	272, 114
Phosphate rock ....do....	87, 869	106, 808	232, 008	279, 389	200, 563	215, 311
Salt (exports) [e] ....do....	209, 900	211, 130	180, 241	222, 535	167, 874	149, 023
Sand ....cubic meters..	(b)	(b)	(b)	(b)	600, 000	(b)
Sodium, carbonate, crude .....tons..	----------	220	779	----------	105	(b)
Stone:						
Basalt ....cubic meters..	2, 500, 000	(b)	2, 244, 800	(b)	130, 000	1, 840, 000
Granite ....do....					10, 000	
Limestone and sandstone do....					1, 950, 000	
Miscellaneous stone [f] .....do....	(b)	(b)	200, 000	(b)	340, 000	----------
Zinc ore ....tons..	----------	----------	----------	840	----------	1, 920

[a] Source of data: Report of the Department of Mines and Quarries, 1928, Cairo; data furnished by the Department of Mines and Quarries, through the American consul, Cairo, except as otherwise noted.
[b] Data not available.
[c] Approximate production. (Imp. Inst., London.)
[d] Figures incomplete; full returns not available.
[e] Data as published by Imp. Inst., London.
[f] Includes some sand and gravel.

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[16] Information furnished by the American consulate, Santo Domingo.

[17] Vaughan, T. W., Cooke, C. W., and others, A Geological Reconnaissance of the Dominican Republic: Dominican Republic Geol. Surv. Mem., vol. 1, Washington, 1921, pp. 228–254.

[18] Information supplied by American consulate, Guayaquil; Ass. Min. Ital., Boll.-Le risorse naturali dell' Equatore. Year 6, Nos. 5–6, Rome, 1924, pp. 279–281.

ERITREA

Mineral production of Eritrea, 1924–1929 [1]

Mineral [2]	1924	1925	1926	1927	1928	1929
Clay, for bricks and pottery........tons..	(3)	(3)	(3)	(3)	23, 960	19, 380
Gems: Peridots..............kilograms..	----------	----------	----------	----------	30	----------
Gold ore..........................tons..	(3)	(3)	(3)	(3)	----------	[4] 100
Mica, sheet..........................do....	----------	----------	----------	----------	----------	5
Salt, marine [5]........................do....	[6] 65, 000	65, 000	65, 000	68, 000	75, 700	115, 000
Sand and gravel....................do....	(3)	(3)	(3)	(3)	36, 045	51, 185
Stone:						
Basalt, teschenite...............do....	(3)	(3)	(3)	(3)	26, 800	46, 095
Granite..........................do....	(3)	(3)	(3)	(3)	3, 648	----------
Limestone—						
For lime.....................do....	(3)	(3)	(3)	(3)	6, 400	6, 070
For other purposes..........do....	(3)	(3)	(3)	(3)	1, 000	1, 000
Road materials...................do....	(3)	(3)	(3)	(3)	72, 350	73, 240

[1] Source of data: Relazione sul Servizio Minerario, Rome, Italy (annual).

[2] An important mineral industry of Eritrea is the production of merchantable potash salts manufactured from the crude salts produced in the potash beds of Ethiopia, which lie about 10 miles inland from the Eritrean frontier.

[3] Data not available.

[4] Average content of gold reported as 30 grams per ton.

[5] Rock salt is also produced and in the form of blocks is used as a medium of exchange in Ethiopian trade, but no data of output are available.

[6] Approximate production.

ESTONIA

Mineral production of Estonia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Calcite, for chemical uses...........tons..	----------	----------	2, 197	690	13, 692	35, 223
Cement..............................do....	64, 800	62, 830	74, 998	53, 000	60, 024	58, 281
Clay (fire clay)......................do....	----------	102	225	364	314	203
Gypsum..............................do....	7, 074	5, 060	4, 828	12, 172	7, 982	8, 093
Lime.................................do....	(2)	4, 889	5, 213	5, 343	16, 350	16, 929
Oil shale.............................do....	233, 631	288, 104	431, 678	397, 609	456, 117	517, 653
Oil, distilled from shale...............do....	412	3, 100	5, 779	4, 292	11, 866	11, 286
Peat, compressed ....cubic meters..	177, 315	191, 827	137, 941	161, 881	150, 000	234, 000
Phosphate rock.......................tons..	----------	2, 044	4, 054	3, 576	6, 858	8, 352

[1] Source of data: Bureau Central de Statistique, Tallinn — Estonie de 1920–1930, Résumé retrospectif; Recueil mensuel; and information furnished through the American consulate, Tallinn.

[2] Data not available.

ETHIOPIA (ABYSSINIA) [19]

Commercially workable deposits of coal, copper, gold, mica, phosphate rock, platinum, potash, rock salt, and sulphur are known in Ethiopia; and occurrences of asbestos, feldspar, iron, lead, limestone, marble, mercury, petroleum, silver, tin, and tungsten are also reported. The only mineral production so far recorded relates to gold, mica, platinum, potash, salt, sulphur, and tungsten ore.

Rich alluvial deposits of gold and platinum are found in the western part of the country in the angle formed by the Birbir and Baro Rivers. Mica of excellent quality occurs in the districts of Harrar and Wallega and in other localities. The large potash deposit in the

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[19] Bordeaux, A., Gisements de mica en Ethiopie: Mines et Carrières, Paris, Sept. 1930, 9 pp.
Chesbrough, R. F., Exploitations of mineral areas in Ethiopia: Commerce Repts., vol. 4, No. 40, Washington, 1929, pp. 30–31.
Hesse, R., Edelmetallvorkommen im Lande Beni-Schangul, Westabessinien: Metall u. Erz., Jahrg. 25, No. 22, Halle a. S., 1928, pp. 582–585.
Hesse, R., Abessinien Platinvorkommen: Metall u. Erz., Jahrg. 23, No. 20, Halle a. S., 1920, pp. 572–573.
Kuntz, J., Eine geologisch-bergmännische Expedition durch Abessinien: Freiberger Geol. Gesell., Bericht 13, Freiberg i. S., 1931, pp. 74–80.
Robertson, H. P., Traveling in Abyssinia: Min. Mag., vol. 40, No. 6, London, 1929, pp. 335–339.
Southard, A. E., American consul, Aden, Arabia. Ms. Consular Rept., Apr. 20, 1920.
Ungemach, H., Sur le gisement potassifère de Dallol, Abyssinie: Soc. Franç. de Minéralogie, Bull., vol. 47, Nos. 1–2, Paris, 1924, pp. 12–32.

Asal salt plain near the borders of Eritrea is well known and has been worked intermittently for a number of years. Reserves[20] have been estimated at 1,000,000 tons. An important deposit said to contain 1,000,000 tons of 90 per cent sulphur lies near the border of Eritrea about 100 kilometers from the Red Sea.

The mineral production of Ethiopia during the period under review is reported as follows:

Mineral production of Ethiopia, 1924–1929[1]

Mineral		1924	1925	1926	1927	1928	1929
Gold, fine[2]	grams	622,000	622,000	622,000	672,000	584,000	140,000
Mica	kilograms				2,000		
Platinum	grams			[3] 11,950	70,000	101,000	240,000
Potash	tons			[4] 1,615	1,000	1,500	(5)
Salt, rock	do	(5)	(5)	(5)	25,000	20,000	10,000
Sulphur	do				3	[illegible]	
Tungsten ore	do					[6] 100	

[1] Source of data: Information furnished by the American Legation, Addis Ababa, and the American consulate, Aden; other sources as noted.

[2] Figures as published by Director, U. S. Mint.

[3] Figure as published by Imp. Inst., London, converted to grams.

[4] Figure as published in Relazione del Servizio Minerario nel 1926, Rome, 1927.

[5] Data not available.

[6] Trial shipment.

FINLAND

Mineral production of Finland, 1924–1929[a]

Mineral		1924	1925	1926	1927	1928	1929
Asbestos:							
Fiber	tons	(b)	1,347	1,674	1,298	1,462	1,563
Flour	do	(b)	224	378	922	604	[illegible]
Cement	do	127,612	[illegible]	163,974	219,480	264,171	262,280
Copper:							
Ore[c]	do	8,358	30,542	22,015	18,743	60,578	106,[illegible]
Electrolytic copper	kilograms	227,000	393,500	365,091	354,000	375,000	[illegible]
Feldspar (exports)	tons	681	753	738	[illegible]	720	400
Gold	grams		700				
Iron:							
Ore	tons	(b)	226				
Pig iron	do	10,653	11,352	8,871	11,860	8,470	6,608
Lead concentrate[d]	do			161	410	344	[illegible]
Lime	do	(b)	52,284	69,578	79,036	81,796	85,171
Peat	bales	328,341	557,548	436,054	454,399	567,809	[illegible]
	cubic meters	8,580	15,930	6,800	9,380	6,844	4,270
	tons	12,795	13,453	11,260	13,367	10,450	11,309
Pyrite	tons	1,064					
Stone:							
Limestone and marble	do	277,648	313,122	286,704	314,108	394,860	391,496
Powdered limestone	do	(b)	(b)	131,614	210,050	(b)	(b)
Talc	do				1,050	4,722	2,848
Zinc concentrate[e]	do			1,714	2,968	1,498	907

[a] Source of data: Annuaire Statistique de Finland, Helsingfors; information furnished by the Central Statistical Bureau, Finland, through the American consul, Helsingfors.

[b] Data not available.

[c] Average copper content reported as follows: 1924, 4.4 per cent; 1925 and 1926, 4.5 per cent; 1927, 4.4 per cent; 1928, 3.6 per cent; 1929, 4.3 per cent.

[d] Average content reported as follows: 1926, Pb 70 per cent; 1927, Pb 65.56 per cent, Zn 7.76 per cent; 1928, Pb 50 per cent; 1929, Pb 8 per cent.

[e] Average content reported as follows: 1926, Zn 37.1 per cent; 1927, Zn 40.07 per cent, Pb 6.01 per cent; 1928, Zn 47.2 per cent; 1929, Zn 42 per cent.

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[20] [illegible], M. R., Potash in 1920: U. S. Geol. Survey, Mineral Resources of the United States, 1920, pt. 2, p. 117.

FRANCE

Mineral production of France, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Diatomite..........tons..	2,300	1,500	7,130	6,000	10,000	5,500
Flint pebbles [2]......do....	(2)	(2)	(2)	(2)	(2)	(2)
Millstones..........do....	26,827	24,350	24,160	25,040	25,600	33,090
Tripoli..........do....	50	44	1	50	----------	2,300
Whetstones, etc.....do....	4,808	770	1,040	1,400	1,140	3,370
Alumina [3]..........do....	62,579	66,847	71,448	90,000	97,000	109,020
Aluminum..........do....	16,315	18,408	23,608	25,042	25,867	29,083
Antimony:						
Ore..........do....	5,105	4,506	2,706	3,350	4,366	5,056
Oxide..........do....	1,065	1,363	934	1,824	1,378	1,190
Regulus..........do....	1,515	1,236	1,167	1,090	731	470
Sulphide..........do....	415	393	463	285	92	134
Sulphuret, golden...do....	114	118	90	148	36	36
Arsenic:						
Ore..........do....	14,029	30,349	23,256	56,822	69,362	47,296
Metallic arsenic.....do....	8	----------	----------	----------	----------	----------
White arsenic.......do....	802	2,217	2,096	2,456	2,947	3,372
Other arsenical products ....tons..	348	----------	----------	29	----------	----------
Asbestos..........do....	882	2,200	660	803	730	750
Asphalt rock..........do....	51,465	52,446	58,240	61,000	65,293	63,693
Barite..........do....	44,189	41,450	38,810	28,300	30,050	41,625
Bauxite..........do....	388,692	502,189	508,129	654,800	636,000	666,348
Bitumen, crude..........do....	26	16	27	14	15	----------
Briquets, fuel..........do....	5,427,105	5,781,037	6,142,355	5,551,200	5,885,616	6,670,256
Cadmium..........kilograms..	(4)	2,669	9,000	19,000	47,000	59,000
Cement..........tons..	3,200,759	3,106,957	3,960,476	3,590,300	4,239,800	5,786,590
Chalk..........do....	67,313	87,700	70,900	79,000	70,000	140,310
Clay:						
Fire clay..........do....	544,585	668,000	731,030	643,700	746,700	798,650
Kaolin..........do....	111,281	124,580	139,630	123,700	124,600	171,850
Other clay..........do....	1,755,648	6,862,850	6,891,650	6,037,900	6,121,100	6,732,740
Coal:						
Anthracite and bituminous..........tons..	44,019,039	47,097,297	51,391,523	51,791,821	51,365,247	53,779,780
Lignite..........do....	962,517	993,352	1,061,122	1,083,041	1,074,627	1,197,220
Coke:						
Gas-house [5]..........do....	2,450,874	2,470,925	2,455,593	2,345,456	2,278,598	2,364,287
Metallurgical.......do....	5,414,664	6,016,000	6,908,000	7,118,000	7,957,000	9,080,127
Coke by-products:						
Ammonium sulphate ....tons..	92,813	103,225	112,705	117,998	124,872	136,975
Benzol..........do....	40,466	54,030	59,216	64,082	77,865	89,531
Tar, crude..........do....	414,414	431,734	452,987	472,253	505,524	555,474
Copper:						
Ore..........do....	265	3,124	324	41	2,167	1,539
Metal (smelter product) ....kilograms..	2,299,000	2,953,000	1,627,000	1,896,000	1,142,000	1,392,000
Feldspar..........tons..	5,800	3,200	10,550	15,000	23,000	12,300
Feldspathic rock........do....	8,313	8,000	8,705	10,000	9,000	----------
Fluorspar..........do....	23,047	24,430	41,670	44,210	46,650	52,968
Gold-bearing ores [6] [7]....do....	86,641	89,619	89,255	129,000	132,738	123,440
Gold, fine..........grams..	462,000	703,000	1,078,000	1,148,000	1,401,000	1,585,000
Graphite..........tons..	514	1,139	950	900	900	783
Gypsum:						
Alabaster..........do....	----------	----------	7	----------	30	50
For agriculture.....do....	72,002	73,640	55,650	90,400	100,100	75,780
Other gypsum.......do....	2,254,836	2,257,000	2,122,300	1,982,600	2,102,600	2,482,180
Iron:						
Ore..........do....	29,044,149	35,597,704	39,317,700	45,482,380	49,191,300	50,731,100
Pig iron [8]..........do....	7,692,565	8,505,244	9,430,025	9,298,620	10,072,100	10,362,072
Lead:						
Ore..........do....	4,895	28,190	10,697	23,490	24,463	19,962
Metal (smelter product) ....kilograms..	18,881,000	20,543,000	19,495,000	32,076,000	22,656,000	20,358,000
Lepidolite..........tons..	----------	----------	250	300	1,000	1,525
Lime, hydraulic........do....	2,355,915	2,433,819	2,436,105	2,159,300	2,253,200	2,373,610
Magnesite (giobertite)..do....	----------	----------	----------	----------	600	----------

[1] Source of data: Statistique de l'Industrie Minérale et des Appareils à Vapeur en France et en Algérie (annual), Paris; and other sources as noted.

[2] France is a large producer and exporter of flint pebbles for grinding, but no figures are available for output or exports.

[3] Produced from bauxite.

[4] Data not available.

[5] For sale.

[6] Includes some auriferous arsenical ores, which are included also under arsenic ores.

[7] Gold content reported as follows: 1924, 1,154,000 grams; 1925, 1,084,000 grams; 1926, 1,365,000 grams; 1927, 1,706,000 grams; 1928, 1,648,000 grams; 1929, 1,773,000 grams.

[8] Includes ferro-alloys.

Mineral production of France, 1924-1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Magnesium, metallic ... kilograms..	22,160	35,300	36,000	35,000	52,000	56,000
Manganiferous iron ore ... tons..	5,000	4,002	4,593	5,590	4,029	2,601
Marls, for agriculture ... do....	443,330	822,580	467,310	446,600	561,800	274,750
Mica ... do....	----------	----------	1	----------	----------	2
Mineral black [9] ... do....	660	562	1,100	1,200	1,200	1,200
Mineral oil, crude distilled from shale ... tons..	4,900	4,663	4,240	5,571	5,263	4,733
Mineral paint ores: Ocher ... tons..	36,500	24,980	60,800	59,300	59,750	55,590
Natural gas ... cubic meters..	----------	----------	----------	----------	----------	326,878
Nickel, metallic [10] ... tons..	2,107	1,638	1,690	1,227	1,772	1,962
Oil shale, including bog head ... tons..	70,968	67,127	69,190	87,500	77,047	78,606
Peat, dry ... do....	23,781	24,601	22,212	21,000	26,977	35,712
Petroleum, crude ... do....	71,058	[11] 65,650	[11] 68,297	[11] 72,670	[11] 74,438	[11] 76,533
Phosphate rock ... do....	206,859	230,496	252,168	217,400	219,200	189,040
Platinum [12] ... grams..	25	----------	60	----------	----------	----------
Potash:						
Crude salts mined ... tons..	1,664,605	1,926,346	2,316,546	2,321,757	2,580,196	3,124,816
Merchantable products—						
Sylvinite, 12 to 16 per cent ... tons..	359,978	358,295	300,280	255,266	215,483	263,019
Sylvinite, 18 to 22 per cent ... tons..	449,385	494,019	479,850	536,347	617,435	711,090
Sylvinite, 30 to 40 per cent ... tons..	----------	----------	182,308	160,557	177,036	227,739
Chloride, 50 per cent and over ... tons..	241,263	181,185	250,430	296,365	336,027	411,832
Total equivalent in K_2O ... tons..	271,625	311,892	366,670	370,901	406,640	492,097
Pyrite, iron ... do....	194,157	212,559	192,340	200,400	198,454	198,705
Salt:						
Rock salt and salt from springs ... tons..	1,317,908	1,458,420	1,643,360	1,518,000	1,707,506	1,746,076
Sea salt ... do....	256,943	262,008	467,610	432,500	407,768	443,685
Sand:						
For foundries ... do....	341,946	409,780	612,770	500,300	415,900	594,090
For glass factories ... do....	338,675	489,830	722,840	630,770	713,600	666,570
Sand, silica, and gravel [13] ... do....	8,195,352	8,588,000	9,090,350	8,379,700	8,429,200	12,744,880
Slate ... do....	290,666	271,000	287,180	297,660	276,490	276,490
Silver ... kilograms..	28,940	44,170	32,099	44,286	53,698	63,007
Sodium, metallic ... tons..	1,286	890	774	750	900	900
Stone:						
Building stone, dressed ... tons..	1,246,112	1,295,000	1,256,930	921,000	953,100	980,500
Dolomite ... do....	73,842	176,850	105,930	100,700	121,300	103,900
Granite, polished ... do....	23,490	26,380	29,470	25,020	26,500	(4)
Limestone—						
For agriculture ... do....	477,470	554,860	530,200	513,400	507,900	765,770
For hydraulic lime and cement ... tons..	7,579,387	8,216,000	9,052,680	8,568,000	9,329,000	10,098,990
Other limestone ... do....	4,132,715	3,995,860	4,587,750	4,477,000	5,384,400	5,391,660
Marble ... do....	20,869	21,420	31,370	40,910	46,210	50,180
Paving stones and flagstones ... tons..	360,695	356,720	366,320	442,300	515,330	544,180
Other stone ... do....	18,902,588	19,175,500	18,860,570	20,010,200	21,560,300	23,241,830
Sulphur rock ... do....	897	149	1,372	600	300	50
Talc ... do....	69,350	69,350	75,740	75,600	89,500	105,560
Tin (smelter product) ... do....	6	29	284	421	572	515
Tin-tungsten ore ... do....	----------	----------	6,560	58	----------	10
Vanadium ... kilograms..	----------	----------	----------	----------	40,000	50,000
Zinc:						
Ore ... tons..	15,072	14,765	11,574	15,200	19,764	7,998
Metal (smelter product) ... kilograms..	57,712,000	64,256,000	64,188,000	79,583,000	92,463,000	87,330,000
Zinc-lead ore ... tons..	62,932	54,727	17,058	23,000	10	17,277

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[9] Made from oil shales.
[10] Made from mattes imported from New Caledonia.
[11] Figures as published by Office National des Combustibles Liquides, Paris.
[12] Produced in metallurgical plants.
[13] Used for mortar, concrete, and other purposes not elsewhere specified.

FRENCH EQUATORIAL AFRICA (CONGO)

Deposits of copper, gold, gem stones (diamonds, garnets), iron, lead, manganese, monazite, petroleum, salt, tin, titanium, zinc, and zircon are reported in the French Congo,[21] but so far as available records show only the copper ores have been exploited. Rich deposits of copper ore, situated between Brazzaville and Loango, have been mined since 1911. The output of ore is reported as follows:[22] 1924, 647 tons; 1925 and 1926, production figures not available, exports of ore reported as 678 tons and 784 tons, respectively; 1927, 1,869 tons; 1928, 3,002 tons; 1929, 3,057 tons.

FRENCH GUIANA

Deposits of bauxite, copper, gold, iron, lead, and mercury are reported in French Guiana,[23] but gold is the only mineral produced, although considerable prospecting has been done on the bauxite deposits, which are extensive. The output of fine gold from 1924 to 1929, inclusive, is given as follows:[24] 1924, 1,251,199 grams; 1925, 1,209,541 grams; 1926, 1,395,776 grams; 1927,[25] 1,354,748 grams; 1928, 1,413,526 grams; 1929, 1,522,186 grams. French Guiana is the largest gold producer of the French colonies.

FRENCH WEST AFRICA

French West Africa, which comprises the colonies of Dahomey, Dakar, Guinea, Ivory Coast, Mauritania, Niger, Senegal, Sudan, Upper Volta, and the mandate territories of Cameroon and Togo, is reported [26] to contain deposits of bauxite, bismuth, bitumen, chromite, copper, gold, gypsum, iron, lead, limestone, manganese, mica, phosphate rock, quartz, salt, tellurium, tin, titanium, tungsten, and zircon; but gold, ilmenite, and salt are the only minerals commercially exploited to date. The output of these minerals is reported as follows:

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[21] Brustier, L., Sur la géologie du Kouango français (Afrique Equatoriale Française)—Oubangui: Ann. des Mines, series 12, vol. 3, Paris, 1923, pp. 137–161.

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[22] Data supplied by the Ministère des Colonies, France, through the American consulate, Paris.

[23] Miller, B. L., and Singewald, J. T., jr., Mineral Deposits of South America: New York, 1919. Snyder, B. M., Mining Conditions in French Guiana: Eng. and Min. Jour., vol. 98, 1914, pp. 509–513. Bordeaux, A., Les mines d'or de la Guyane Française: Mines et Carrières, 1930.

[24] Information supplied by the American consulate, Georgetown, British Guiana.

[25] Exports.

[26] Chêtelat, E. de., Reconnaissance sur les terrains d'origine du Bas-Dahomey: Comité d'Etudes Hist. et Sci. de l'Afrique Occ. Franç., Bull. vol. 10, No. 1, Paris, 1927, pp. 8–37.

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Information furnished by the American consulates at Dakar, Senegal, and Lagos, Nigeria.

Mineral production of French West Africa, 1924–1929 [1]

Mineral and colony		1924	1925	1926	1927	1928	1929
Gold, fine [2]:							
Guinea	grams	219,333	115,089	139,526	190,538		[4] [5] 63,447
Ivory Coast	do	21,250	9,080	19,272	32,583	[3] 10,000	[4] 2,515
Senegal	do	84,239	37,169	48,202	31,321		
Sudan	do	84,239	([5])	64,634	30,691	[3] 46,000	([5])
Upper Volta	do		40,000				
Total	do	409,061	([6])	271,634	285,133	[3] 56,000	65,962
Ilmenite: Senegal	tons	352	181	5,748	5,199	2,110	[4] 7,240
Salt: Mauritania	do	([6])	4,500	4,500	4,250	4,000	[7] 4,000

[1] Data furnished by the American consulate, Dakar, Senegal, except as otherwise noted.

[2] The total gold production of French West Africa, as published by the Director, U. S. Mint, is as follows: 1924, 408 kilograms; 1925, 304 kilograms; 1926, 310 kilograms; 1927, 213 kilograms; 1928, 102 kilograms; 1929, 129 kilograms (subject to revision).

[3] Data as published in Stat. de l'Ind. Min. en France et en Algérie, 1928, Paris, 1929.

[4] Exports.

[5] Figures for Sudan included under Guinea.

[6] Data not available.

[7] Approximate production.

FRENCH WEST INDIES

Guadeloupe.[27]—No minerals are produced in the island of Guadeloupe or its dependencies. Iron sand is found on the coast, but its commercial value is said to be negligible. Considerable quantities of sulphur are found in the vicinity of the Grande Soufrière volcano, but distance from the sea and lack of transport facilities render exploitation unprofitable.

Martinique.—No minerals are produced on the island of Martinique. Large deposits of pumice are reported near Mont Pelée, but it is not pure enough to be of commercial value. Iron sand is found in some places on the coast.[28] Discovery of a bed of lignite near Morne Rouge has been reported,[29] but as yet the deposit has not been exploited commercially.

GERMANY

Mineral production of Germany, 1924–1929 [a]

Mineral		1924	1925	1926	1927	1928	1929
Abrasives: Diatomite (exports) [b]	tons	4,326	4,555	5,919	6,023	6,703	8,701
Arsenic ore	do	57,485	32,081	20,797	23,783	25,710	27,866
Asphalt rock	do	57,359	64,115	60,966	117,836	158,329	145,341
Bauxite	do	3,085	1,767			6,860	7,256
Boracite	do	207	72	44	34	38	54
Briquets:							
Coal [c]	do	4,359,476	5,590,613	5,902,339	5,555,265	5,375,842	6,059,195
Lignite	do	29,399,746	33,663,447	34,358,043	36,489,901	40,157,264	42,136,834
Bromine	do	643	1,591	1,383	1,676	1,707	2,197
Cadmium	kilograms	1,147	([d])	([d])	([d])	([d])	([d])

[a] Source of data: Vierteljahrshefte zur Statistik des Deutschen Reichs, Berlin (annual); Statistische Uebersicht über die Kohlenwirtschaft, Berlin (annual), except as otherwise noted. The statistics published by the Statistisches Reichsamt in the Vierteljahrshefte do not cover all minerals produced in Germany, as is evident from the table below, which gives the output of Bavaria, Prussia, and Saxony as published by their respective mining bureaus. Similar statements for the other States of Germany are not available.

[b] Data from Auswärtiger Handel Deutschlands.

[c] Includes the output of the Saar, as follows: 1926, 746 tons; 1927, 285 tons. No production reported for other years.

[d] Data not available. Approximate annual output estimated at 45,000 kilos. (Imp. Inst., London.)

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[27] Information supplied by the American consulate, Guadeloupe.

[28] Information supplied by the American consulate, Fort de France.

[29] Information supplied by W. S. Reineck, American consul, Martinique, Apr. 10, 1929.

Mineral production of Germany, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Coal:						
Bituminous [e] ....tons..	132, 800, 868	145, 611, 975	158, 976, 598	167, 195, 464	163, 967, 317	177, 019, 980
Lignite ....do....	124, 637, 201	139, 724, 614	139, 150, 557	150, 503, 914	165, 588, 097	174, 455, 946
Cobalt-nickel-bismuth-tin-antimony-uranium ore ....tons..	21, 517	17, 013	20, 558	20, 287	14, 718	22, 384
Coke:						
Gas-house ....do....	4, 300, 000	4, 505, 000	4, 498, 000	[f] 4, 632, 000	[f] 4, 603, 000	[f] 4, 888, 000
Metallurgical [g] [h] ....do....	26, 634, 789	30, 344, 379	29, 406, 398	35, 474, 495	37, 147, 959	41, 844, 033
Coke by-products (from coke plants):						
Ammonium sulphate ....tons..	327, 519	400, 570	380, 444	458, 430	468, 194	532, 033
Benzol ....do....	194, 089	247, 748	244, 599	306, 557	333, 152	386, 283
Tar [i] ....do....	815, 649	982, 258	965, 616	1, 187, 375	1, 239, 842	1, 425, 306
Copper:						
Ore ....do....	791, 602	810, 729	932, 332	950, 396	908, 506	1, 025, 455
Blister copper [j] ....kilograms..	453, 000	6, 391, 000	14, 267, 000	17, 994, 000	14, 557, 000	18, 119, 000
Cement copper [j] ....do....	2, 320, 000	2, 357, 000	2, 596, 000	2, 610, 000	2, 695, 000	3, 171, 000
Electrolytic copper [k] ....kilograms..	33, 310, 000	46, 244, 000	56, 837, 000	71, 953, 000	79, 514, 000	93, 451, 000
Refined copper .....do....	37, 777, 000	33, 954, 000	28, 518, 000	21, 868, 000	28, 703, 000	30, 874, 000
Copper vitriol ......tons..	6, 661	7, 957	9, 264	16, 435	19, 829	15, 832
Glauber salts ....do....	43, 144	51, 145	85, 574	109, 080	108, 000	128, 649
Gold, fine [l] ....grams..	13, 908, 810	14, 807, 110	12, 625, 770	12, 100, 610	15, 952, 310	18, 394, 040
Graphite ....tons..	10, 079	16, 853	14, 304	17, 773	17, 464	21, 349
Iron:						
Ore [m] ....do....	4, 284, 789	5, 742, 686	4, 594, 937	6, 315, 186	6, 296, 261	6, 191, 232
Pig iron [n] ....do....	9, 221, 671	11, 541, 807	11, 274, 105	14, 859, 516	13, 739, 749	15, 344, 395
Lead:						
Ore [o] ....tons..	418, 571	469, 716	535, 150	571, 523	606, 788	637, 817
Antimonial lead [p] ....kilograms..	4, 260, 000	7, 121, 000	6, 141, 000	7, 625, 000	9, 073, 000	7, 708, 000
Soft lead [p] ....do....	63, 167, 000	82, 337, 000	90, 059, 000	101, 849, 000	113, 507, 000	116, 518, 000
Work lead [j] [p] ....do....	14, 868, 000	17, 779, 000	19, 711, 000	19, 150, 000	19, 243, 000	19, 564, 000
Zincky lead [j] ....do....	------------	169, 000	71, 000	483, 000	138, 000	135, 000
Litharge ....tons..	10	24	45	51	43	41
Magnesium chloride:						
Liquid ....do....	29, 139	69, 052	60, 255	62, 745	76, 128	70, 228
Solid ....do....	27, 635	32, 159	38, 143	35, 445	38, 665	38, 001
Magnesium sulphate [q] ..do....	75, 385	104, 133	84, 412	125, 376	158, 279	202, 294
Manganese ore [r] ....do....	3, 554	144	25	30	210	475
Manganiferous iron ore [s] ....do....	168, 758	180, 213	198, 391	310, 320	178, 354	181, 970
Petroleum, crude ....do....	59, 352	79, 130	95, 392	[t] 96, 877	92, 045	102, 867
Platinum, palladium, etc. [u] ....grams..	------------	------------	------------	------------	376, 320	410, 610
Potash:						
Crude salts mined—						
Carnallite, including natutal kieserite ....tons..	2, 847, 862	2, 831, 658	1, 867, 129	1, 773, 195	2, 057, 760	2, 317, 940
Kainite, sylvinite, etc. ....tons..	5, 243, 255	9, 197, 918	7, 540, 980	9, 298, 346	10, 431, 310	10, 998, 278
Total equivalent in K_2O ....tons..	([v])	1, 574, 839	1, 262, 589	1, 518, 037	1, 691, 128	1, 787, 775

[e] Includes output of the Saar as follows: 1924, 14,032,120 tons; 1925, 12,989,850 tons; 1926, 13,680,874 tons, 1927, 13,595,824 tons; 1928, 13,106,718 tons; 1929, 13,579,348 tons.

[f] Year ended Mar. 31 of year following that stated.

[g] Includes the output of the Saar as follows: 1924, 1,750,000 tons; 1925, 1,947,000 tons; 1926, 2,109,000 tons; 1927, 2,232,000 tons; 1928, 2,373,000 tons; 1929, 2,423,000 tons.

[h] In addition, the following quantities of low-grade coke were produced in lignite, shale, and peat distillation plants: 1924, 396,716 tons; 1925, 404,697 tons; 1926, 444,538 tons; 1927, 468,692 tons; 1928, 636,639 tons; 1929, 759,722 tons.

[i] In addition, the following quantities of tar were produced in lignite, shale, and peat distillation plants: 1924, 74,721 tons; 1925, 74,304 tons; 1926, 78,293 tons; 1927, 83,646 tons; 1928, 170,074 tons; 1929, 197,462 tons.

[j] For sale.

[k] Includes copper made from foreign refined copper reworked.

[l] The estimated gold content of all ores raised in Germany is reported as follows: 1924, 266,076 grams; 1925, 181,628 grams; 1926, 162,168 grams; 1927, 180,268 grams; 1928, 168,971 grams; 1929, 181,134 grams.

[m] Exclusive of manganiferous iron ore carrying 12 to 30 per cent of Mn.

[n] Includes the output of the Saar as follows: 1924, 1,389,117 tons; 1925, 1,453,056 tons; 1926, 1,638,051 tons; 1927, 1,770,718 tons; 1928, 1,936,184 tons; 1929, 2,104,940 tons.

[o] Lead content reported as follows: 1924, 19,291 tons; 1925, 20,957 tons; 1926, 23,770 tons; 1927, 24,928 tons; 1928, 27,825 tons; 1929, 28,653 tons.

[p] Includes some secondary material.

[q] Includes some kieserite.

[r] Average Mn content above 30 per cent.

[s] Ores containing from 12 to 30 per cent of Mn.

[t] The sum of the quantities reported by the Prussian and Bavarian mining bureaus, 96,883 tons and 21 tons, respectively, is 96,904 tons.

[u] Produced in smelters.

[v] Data not available.

Mineral production of Germany, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Potash—Continued.						
Merchantable products—						
Carnallite, 9 to 12 per cent of K_2O tons	170,319	18,818	73,544	19,328	20,862	29,462
Chloride do	341,503	376,332	342,503	370,504	465,710	535,176
Fertilizer salts do	1,332,407	2,234,031	1,734,839	2,050,669	2,216,428	2,264,309
Potassium sulphate tons	108,263	162,539	106,309	161,004	211,729	247,813
Potash-magnesium sulphate tons	46,948	45,379	50,644	60,695	57,033	85,178
Salts, crude, 12 to 15 per cent of K_2O tons	1,193,503	1,906,023	1,568,378	1,720,488	1,867,051	1,563,320
Other salts do	15,321	------	------	------	------	------
Total equivalent in K_2O tons	895,600	1,351,294	1,088,696	1,268,798	1,431,505	1,482,501
Pyrite, iron [23] do	159,623	223,293	237,870	350,430	342,179	351,909
Salt:						
Rock salt do	1,596,416	1,767,282	1,965,847	2,268,807	2,399,669	2,541,489
Brine salt do	377,277	456,810	479,547	533,984	509,663	501,024
Silver, fine [24] kilograms	395,142	478,561	428,432	530,973	724,078	889,170
Tin (smelter product) tons	2,528	1,539	2,307	6,236	4,744	2,671
Tungsten ores: Wolfram tons	[25] 13	(26)	------	------	------	------
Zinc:						
Ore [27] do	12,021	19,617	20,325	52,362	103,103	72,707
Crude zinc [10] kilograms	40,209,000	58,066,000	67,079,000	80,948,000	95,194,000	99,541,000
Refined zinc do	701,000	4,428,000	6,637,000	8,889,000	9,513,000	8,888,000
Zinc dust [10] tons Zinc oxide [10] do	18,279	16,345	20,798	17,487	30,435	37,154
Zinc-lead ore [28] do	810,581	876,486	1,140,317	1,216,741	1,173,021	1,162,574

[10] For sale.

[23] Sulphur content reported as follows: 1924, 48,144 tons; 1925, 82,041 tons; 1926, 98,939 tons; 1927, 149,531 tons; 1928, 145,866 tons; 1929, 149,983 tons.

[24] The estimated silver content of all ores raised in Germany is reported as follows: 1924, 138,343 kilos; 1925, 148,690 kilos; 1926, 166,683 kilos; 1927, 164,648 kilos; 1928, 162,390 kilos; 1929, 171,467 kilos.

[25] Concentrates produced from old dumps.

[26] Statistisches Reichsamt reports no production but 6,015 tons of ore sold from old dumps.

[27] Zinc content reported as follows: 1924, 1,389 tons; 1925, 2,267 tons; 1926, 2,376 tons; 1927, 15,403 tons; 1928, 20,203 tons; 1929, 7,719 tons.

[28] Metal content reported as follows: 1924, lead, 17,211 tons, zinc, 57,054 tons; 1925, lead, 21,822 tons, zinc, 67,030 tons; 1926, lead, 30,144 tons, zinc, 102,048 tons; 1927, lead, 32,622 tons, zinc, 126,226 tons; 1928, lead, 29,757 tons, zinc, 124,183 tons; 1929, lead, 31,811 tons, zinc, 134,748 tons.

Mineral production of Bavaria, Prussia, and Saxony, 1924–1929 [1]

State and mineral	1924	1925	1926	1927	1928	1929
BAVARIA						
Abrasives:						
Emery tons	350	370	375	385	411	394
Whetstones do	14	12	55	43	31	9
Barite do	23,029	21,477	26,955	20,035	23,872	23,406
Briquets, fuel:						
Coal [2] do	(3)	(3)	90,128	83,598	86,016	(3)
Lignite [2] do	(3)	(3)	157,935	189,744	203,473	(3)
Chalk do	[4] 19,310	[4] 16,073	2,905	4,075	3,687	3,597
Clay:						
Fire clay do	[5] 251,596	311,304	241,162	378,098	395,656	366,663
Kaolin do	357,842	372,896	421,581	382,430	379,469	383,002
Other clay do	(5)	(5)	69,504	50,122	78,712	63,570
Coal:						
Bituminous [6] do	33,779	37,069	36,149	4,409	1,403	2,146
Lignite do	2,387,601	2,171,463	2,211,619	2,140,131	2,026,366	2,209,713
Copper, lead, and tin ores tons	9,433	8,051	3,287	2,245	1	17
Feldspar do	33,138	10,258	6,660	7,320	6,230	7,697
Fluorspar do	21,663	31,454	32,475	51,001	48,552	50,797

[1] Source of data except as otherwise noted: Bavaria—Statistik über Bergbau, Steinbrüche und Gräbereien, Hütten, und Salinen in Bayern, Munich (annual); Prussia—Ztschr. für das Berg-, Hütten.- und Salinenwesen im Preuss. Staate, Berlin (annual); Saxony—Jahrbuch für das Berg- und Hüttenwesen in Sachsen, Freiberg (annual).

[2] Vierteljahrshefte zur Statistik des Deutschen Reichs.

[3] Data not available.

[4] Includes some silica, the so-called Neuburger chalk, which in subsequent years is included under silica.

[5] Some bleaching and other clays included with fire clay.

[6] Exclusive of output of the Saar.

Mineral production of Bavaria, Prussia, and Saxony, 1924–1929—Continued

State and mineral	1924	1925	1926	1927	1928	1929
BAVARIA—continued						
Gold and silver bearing ores.....tons	1, 344	2, 600	------	------	------	------
Graphite.....do	10, 079	16, 853	14, 305	17, 773	17, 464	21, 349
Gypsum.....do	43, 331	57, 884	45, 690	59, 772	54, 482	60, 192
Iron:						
Ore.....do	373, 689	514, 931	417, 111	552, 933	615, 589	615, 518
Pig iron.....do	159, 749	244, 725	225, 476	302, 539	306, 238	291, 403
Lithographic stone.....do	(3)	(3)	3, 736	4, 286	2, 655	3, 223
Marl, for cement.....do	54, 867	72, 327	52, 947	47, 623	49, 279	31, 663
Mineral paint ores: Ocher, etc.....tons	7, 974	11, 086	8, 024	13, 846	13, 655	11, 878
Natural gas.....cubic meters	(7)	(7)	(7)	(7)	(7)	(7)
Oil shale.....tons	530	400	10	480	670	603
Petroleum, crude.....do	53	20	29	21	20	12
Phosphate rock.....do	1, 000	200	------	------	------	------
Pyrite,[8] alum, and vitriol ores.....tons	6, 638	5, 475	9, 049	11, 047	12, 300	23, 396
Salt:						
Rock salt.....do	107	260	234	357	392	462
Brine salt.....do	31, 648	39, 995	44, 380	50, 377	48, 424	47, 093
Silica (quartz).....do	527, 982	473, 923	434, 134	633, 396	703, 573	766, 666
Slate (roofing slates and slabs.....tons	210	190	162	178	105	80
Soapstone.....do	3, 997	3, 461	3, 834	6, 381	7, 872	6, 805
Stone:						
Basalt.....do	720, 536	1, 125, 781	1, 266, 234	1, 401, 572	1, 529, 641	1, 645, 930
Flagstones and roofing slabs.....tons	4, 110	10, 619	3, 397	12, 154	20, 568	12, 188
Granite, diorite, syenite, and similar stone.....tons	566, 779	672, 083	816, 599	897, 209	895, 200	852, 600
Limestone, marble, and dolomite.....tons	1, 711, 410	1, 970, 477	1, 894, 427	2, 481, 186	2, 498, 389	2, 298, 806
Porphyry, melaphyre, and diabase.....tons	335, 885	864, 949	803, 995	1, 012, 656	980, 747	1, 082, 982
Sandstone.....do	276, 252	317, 581	336, 613	430, 799	454, 319	394, 824
Serpentine.....do	40, 762	61, 681	56, 076	60, 942	78, 528	76, 110
Trass.....do	13, 700	6, 500	1, 569	18, 234	35, 004	836
PRUSSIA						
Amber, crude.....tons	501	547	540	414	481	516
Arsenic ore.....do	11, 044	6, 839	3, 917	4, 710	4, 374	4, 454
Asphalt rock.....do	3, 750	1, 140	------	------	------	------
Barite.....do	102, 326	151, 243	135, 319	154, 794	232, 858	260, 811
Bischofite.....do	3, 064	5, 944	7, 000	8, 426	9, 548	11, 477
Boracite.....do	44	84	43	27	29	48
Briquets, fuel: [2]						
Coal [6].....do	3, 531, 200	4, 636, 039	5, 158, 794	4, 812, 410	4, 641, 966	5, 162, 207
Lignite.....do	23, 785, 574	27, 752, 130	28, 127, 718	30, 064, 015	33, 067, 353	35, 011, 450
Bromine [2].....do	505	1, 290	1, 229	1, 394	1, 496	1, 376
Cadmium.....kilograms	1, 147	(3)	(3)	(3)	(3)	(3)
Clay:						
Fire clay.....tons	116, 892	131, 269	110, 667	130, 432	121, 352	105, 066
Kaolin.....do	------	------	7, 186	3, 782	14, 230	16, 240
Other clay.....do	260, 278	311, 694	303, 194	409, 058	466, 278	520, 244
Coal:						
Bituminous [6].....do	114, 732, 086	128, 552, 469	140, 991, 203	149, 428, 486	146, 695, 749	159, 130, 478
Lignite.....do	101, 429, 121	115, 122, 092	115, 337, 592	126, 662, 141	140, 449, 667	148, 895, 711
Coke, metallurgical [2] [6].....do	24, 256, 216	27, 709, 195	26, 625, 475	32, 351, 451	33, 859, 205	38, 429, 645
Copper:						
Ore.....do	792, 041	810, 414	933, 608	952, 089	906, 354	1, 025, 708
Blister copper [2] [9].....kilograms	412, 000	6, 391, 000	10, 617, 000	14, 899, 000	14, 557, 000	18, 050, 000
Cement copper [2] [9].....do	------	60, 000	6, 000	2, 000	------	------
Electrolytic copper [2].....kilograms	9, 302, 000	15, 241, 000	17, 135, 000	23, 757, 000	23, 880, 000	27, 065, 000
Refined copper [2].....do	33, 840, 000	30, 961, 000	28, 518, 000	21, 868, 000	27, 493, 000	30, 274, 000
Copper vitriol [2].....tons	212	85	132	231	1, 288	72
Fluorspar.....do	13, 078	24, 101	29, 729	36, 607	37, 365	37, 717
Glauber salts [2].....do	12, 375	7, 447	11, 056	------	------	------
Gold, fine [2].....grams	9, 488, 570	11, 461, 260	9, 259, 730	7, 506, 140	11, 147, 210	13, 171, 160
Gypsum: Alabaster.....tons	422	405	262	538	452	402
Iron:						
Ore.....do	3, 467, 692	4, 332, 466	3, 368, 235	4, 569, 743	4, 296, 525	4, 308, 867
Pig iron [2] [6].....do	7, 434, 029	9, 499, 299	9, 155, 156	12, 399, 377	10, 995, 059	12, 456, 414

[2] Vierteljahrshefte zur Statistik des Deutschen Reichs.
[3] Data not available.
[6] Exclusive of output of the Saar.
[7] In the Danube-Inn section natural gas is known at many places and is used to a small extent for domestic heating and lighting, but there is no industrial or commercial utilization.
[8] Exclusive of gold and silver bearing pyrite, which is included under gold and silver bearing ores.
[9] For sale.

Mineral production of Bavaria, Prussia, and Saxony, 1924–1929—Continued

State and mineral	1924	1925	1926	1927	1928	1929
PRUSSIA—continued						
Langbeinite ....tons..	10, 203	49, 768	23, 956	------------	------------	------------
Lead:						
Ore ....do....	91, 095	98, 867	125, 706	136, 072	166, 970	167, 102
Antimonial lead [2] ....kilograms..	1, 729, 000	4, 290, 000	5, 042, 000	5, 223, 000	7, 118, 000	5, 590, 000
Soft lead [2]...........do....	38, 473, 000	50, 500, 000	57, 892, 000	62, 455, 000	65, 246, 000	66, 707, 000
Work lead [2] [9].........do....	9, 772, 000	11, 157, 000	11, 605, 000	11, 197, 000	11, 083, 000	11, 140, 000
Zincky lead [2] [9].........do....	9, 000	31, 000	71, 000	166, 000	138, 000	135, 000
Manganese ore...........tons..	317	144	25	30	210	475
Mineral paint ores:						
Ocher...............do....	120	------------	------------	------------	------------	------------
Other...............do....	1, 671	2, 454	2, 524	2, 523	2, 530	2, 733
Petroleum, crude.......do....	59, 299	79, 104	95, 338	96, 883	92, 003	102, 843
Phosphate rock.........do....	399	123	542	443	------------	------------
Platinum.............grams..	------------	------------	------------	------------	170, 200	200, 530
Potash:						
Crude salts mined—						
Carnallite, including natural kieserite ....tons..	1, 954, 915	1, 989, 681	1, 388, 618	1, 261, 116	1, 420, 363	1, 695, 037
Kainite, sylvinite, etc. ....tons..	3, 814, 459	6, 244, 816	4, 860, 949	5, 324, 082	5, 899, 697	5, 908, 381
Pyrite, iron.............do....	116, 357	202, 791	235, 600	345, 493	338, 628	334, 079
Salt:						
Rock salt...........do....	640, 650	816, 869	960, 279	1, 267, 711	1, 392, 607	1, 534, 134
Brine salt...........do....	214, 605	252, 070	277, 801	300, 419	273, 868	261, 092
Sand.................do....	165	------------	1, 505	1, 645	1, 874	2, 714
Silver, fine [2].......kilograms..	228, 204	260, 360	273, 590	324, 234	456, 472	658, 522
Slate:						
Ground slate........tons..	------------	------------	------------	2, 413	------------	3, 163
Roofing slate.....meters..	371, 403	533, 721	521, 550	484, 124	594, 333	334, 927
Slabs......square meters..	18, 833	23, 462	19, 442	22, 128	34, 387	23, 796
Stone:						
Basalt..............tons..	162, 542	386, 820	347, 916	516, 318	520, 941	547, 709
Limestone..........do....	21, 090	16, 500	13, 710	17, 140	15, 996	14, 418
Marble.............do....	483	600	160	400	350	------------
Quartzite...........do....	725	------------	------------	------------	------------	------------
Trachyte...........do....	7, 747	17, 699	11, 677	16, 247	13, 669	18, 069
Strontianite............do....	620	800	------------	721	871	729
Trass...................do....	88, 195	42, 370	47, 820	61, 465	51, 372	42, 750
Uranium ore............do....	------------	------------	------------	3	2	2
Zinc:						
Ore.................do....	104, 941	122, 794	190, 578	275, 378	264, 924	276, 374
Crude zinc [2] [9]..kilograms..	35, 057, 000	49, 955, 000	55, 359, 000	63, 157, 000	70, 277, 000	77, 418, 000
Refined zinc [2].......do....	701, 000	4, 428, 000	6, 637, 000	8, 718, 000	9, 129, 000	8, 641, 000
Zinc dust [2] [9] Zinc oxide [2] [9] } tons..	2, 731	1, 682	2, 078	3, 942	15, 564	21, 067
SAXONY						
Arsenic ore..............tons..	164	------------	------------	------------	------------	------------
Barite...................do....	2, 076	968	------------	------------	1, 401	1, 870
Bismuth-cobalt-nickel ores ....tons..	102	125	113	92	82	48
Briquets, fuel: [2]						
Coal................do....	72, 898	83, 010	95, 883	70, 785	86, 612	117, 639
Lignite.............do....	2, 549, 249	2, 755, 673	2, 910, 231	3, 068, 615	3, 375, 391	3, 603, 195
Clay:						
Kaolin—						
Crude..........do....	36, 119	40, 840	50, 175	57, 580	53, 711	48, 970
Slummed and sorted ....tons..	39, 272	52, 177	57, 331	56, 100	63, 204	65, 299
Other clay..........do....	37, 222	46, 047	46, 881	55, 993	59, 063	60, 377
Coal:						
Bituminous.........do....	3, 817, 284	3, 869, 244	4, 147, 160	4, 032, 315	4, 041, 703	4, 177, 471
Lignite.............do....	8, 958, 490	9, 918, 874	10, 053, 534	10, 753, 872	11, 937, 407	12, 967, 953
Coke, metallurgical [2]....do....	204, 097	198, 343	176, 936	226, 194	229, 242	231, 497
Fluorspar...............tons..	9, 032	16, 141	17, 442	22, 027	16, 422	18, 491
Iron ore ....do....	1, 760	40	8	------------	------------	------------
Lead ore, argentiferous ....kilograms..	584, 000	664, 000	408, 000	556, 000	339, 000	400
Lepidolite ....tons..	------------	501	665	605	269	789
Lime....................do....	30, 894	33, 601	24, 980	32, 098	36, 504	31, 220
Manganese ore.........do....	33	------------	------------	------------	------------	------------
Manganiferous iron ore..do....	------------	------------	------------	------------	------------	150
Mineral paint ores......do....	3, 107	9	11	8	10	21
Pyrite						
Arsenical pyrite......do....	27	6	------------	------------	------------	------------
Iron pyrite ....do....	120	105	45	45	120	122

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[2] Vierteljahrshefte zur Statistik des Deutschen Reichs.
[9] For sale.

Mineral production of Bavaria, Prussia, and Saxony, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
SAXONY—continued						
Sand, gravel,[10] and broken stone……tons	5, 592	8, 095	7, 827	13, 081	14, 419	14, 111
Silica (quartz)……do	112	------	------	------	------	------
Stone:						
Limestone……do	[11] 34, 052	[11] 20, 490	[11] 48, 605	[11] 58, 563	[11] 26, 565	22, 397
Serpentine……do	858	458	165	237	275	311
Tin ore (including slimes)……tons	98	80	95	94	67	70
Tungsten ore: Wolfram……do	12	------	------	------	------	------
Zinc ore……do	12	18	77	------	------	------

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[10] Exclusive of sand for which the value only is given. The values reported, converted from Reichsmarks, at the average annual rate of exchange published by the U. S. Federal Reserve Board. are as follows: 1924, $450; 1925, $998; 1926, $1,837; 1927, $2,166; 1928, $1,661; 1929, $2,749.

[11] Reported as "raw lime."

GOLD COAST AND ASHANTI

Mineral production of the Gold Coast and Ashanti, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Gems: Diamonds (exports)[2]……carats	[3] 66, 946	[3] 77, 314	299, 835	460, 959	[3] 698, 826	660, 536
Gold, fine……grams	6, 404, 300	6, 179, 888	6, 206, 544	5, 336, 891	4, 908, 596	6, 774, 525
Manganese ore (exports)……tons	259, 441	362, 897	377, 284	409, 658	348, 755	465, 282
Silver, fine[4]……kilograms	220	200	200	170	156	233

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[1] Source of data: Government of the Gold Coast—Report on the Mines Department (annual), except as otherwise noted.

[2] Figures as published by the Imp. Inst., London.

[3] Production is reported as follows for 1924, 1925, and 1928: 1924, 53,035 carats; 1925, 84,985 carats; 1928, 789,249 carats (Imp. Inst., London). Data not available for other years.

[4] Estimated output. (Imp. Inst., London.)

GREECE

Mineral production of Greece, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Emery……tons	23, 000	20, 354	27, 240	15, 848	13, 129	10, 560
Millstones……number	2, 790	3, 850	7, 884	4, 472	5, 330	1, 893
Antimony ore……tons	------	------	------	------	------	137
Arsenic, white……do	1, 096	423	1, 148	1, 036	709	763
Bauxite……do	1, 300	3, 700	2, 320	4, 300	300	6, 280
Bituminous limestone……do	5, 013	5, 256	402	290	3, 173	1, 196
Briquets (lignite)……do	------	------	------	86	------	------
Chromite[2]……do	15, 061	8, 079	20, 049	17, 314	20, 953	24, 214
Coal, lignite……do	131, 109	142, 076	153, 321	143, 346	120, 639	156, 526
Copper, ore[3]……do	------	------	------	------	20	7
Gypsum……do	22, 207	10, 060	9, 723	2, 014	------	------
Iron ore……do	102, 221	88, 216	126, 624	123, 865	166, 868	253, 025
Lead:						
Ore[4]……do	70, 921	76, 916	84, 360	89, 893	70, 689	44, 800
Metal (work lead)……kilograms	5, 106, 000	5, 366, 000	5, 059, 000	5, 325, 000	7, 306, 000	5, 361, 000
Magnesite:						
Crude mined……tons	66, 727	90, 828	95, 638	84, 484	104, 421	84, 023
Calcined……do	20, 386	29, 292	26, 791	27, 433	26, 201	32, 602
Dead burned……do	1, 142	------	1, 214	1, 365	130	1, 249
Manganese ore[5]……do	5, 726	4, 303	6, 348	8, 283	1, 080	1, 600

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[1] Source of data: Statistique de l'Industrie Minière de la Grèce, Direction du Service des Mines, Athens (annual).

[2] Average content of $Cr_2 O_3$ reported as follows: 1924, 40 per cent; 1925, 40.54 per cent; 1926, 39.53 per cent; 1927, 39.84 per cent; 1928, 35.54 per cent; 1929, 39.13 per cent.

[3] Average copper content reported as 6 per cent.

[4] Average content reported as follows: 1924, not stated; 1925, lead 8.85 per cent, silver 117 grams; 1926, lead, 6.41 per cent, silver 99.6 grams; 1927, lead 5.66 per cent, silver 101 grams; 1928, lead 6.41 per cent, silver, 10 grams; 1929, lead 7.35 per cent, silver 12 grams.

[5] Average manganese content reported as follows: 1924, 43.6 per cent; 1925, 34.12 per cent; 1926, 34.16 per cent; 1927, 30.82 per cent; 1928, 35 per cent; 1929, 35.7 per cent.

Mineral production of Greece, 1924–1929—Continued

Mineral		1924	1925	1926	1927	1928	1929
Manganiferous iron ore [6]	tons	800	780	725	623	37	2
Nickel ore [7]	do		...	...	500	10,800	4,309
Petroleum, crude	do		226	514		...	300
Pyrite, iron	do	76,262	65,000	81,000	100,050	94,270	134,399
Salt, from sea water	do	68,542	79,316	89,726	104,378	[8] 100,000	[8] 100,000
Santorin earth	do	79,722	157,800	127,384	44,780	120,692	79,201
Stone: Marble	cubic meters	2,303	2,318	2,097	1,716	1,700	1,911
Sulphur:							
Sulphur rock	tons	2,594	1,050	2,444	2,432	304	1,771
Crude sulphur	do	393	149	226	249	25	190
Talc	do	139	94	151	213	30	150
Zinc:							
Ore [9]	do	4,861	7,594	34,751	30,597	17,671	29,011
Calcined calamine	do	4,188	2,343	10,318	11,916	6,138	6,237
Zinc-lead ore [10]	do	81	614	...	4,452	9,496	8,407

[6] Average manganese content reported as 12 per cent.

[7] Average nickel content reported as follows: 1927, 5 per cent; 1928 and 1929, 6 per cent.

[8] Approximate production. (Imp. Inst., London.)

[9] Average zinc content reported as follows: 1924, 24.5 per cent; 1925, 25.77 per cent; 1926, 17.28 per cent; 1927, 21.04 per cent; 1928, 19.95 per cent; 1929, 17.12 per cent.

[10] Average metal content reported as follows: 1924, zinc 11 per cent, lead 11 per cent; 1925, 1927, 1928, and 1929, zinc 10 per cent, lead 11 per cent, silver 100 grams per ton.

GREENLAND

Mineral production of Greenland, 1924–1929, in metric tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Coal	2,500	2,100	1,500	2,900	3,000	3,600
Cryolite	22,850	45,808	24,835	19,293	25,935	29,780
Graphite [2]	53	32	...	...	...	...

[1] Source of data: Information supplied by the Styrelsen af Kolonierne i Grønland, through the American consulate, Copenhagen.

[2] Concentrated.

GUATEMALA

The mineral resources of Guatemala are reported to include antimony, asphalt, chromite, coal (lignite), gold, graphite, gypsum, iron, lead, manganese, marble, mica, ocher, petroleum, potash, salt silver-lead, sulphur, talc, and zinc.[30] Asphalt is found in the Department of Izabal. The principal chrome deposits are in the Department of Jalapa. Lignite is said to occur in the Departments of Petén and Sacatepequez, but even if found in commercial quantities lack of transportation would militate against profitable exploitation. Fluorspar is found in the Departments of Baja Verapaz and Quiché, but the deposits remain undeveloped. Lead occurs principally in the Department of Huehuetenango, and a silver-lead mine is worked in the Department of Chiquimula. A large deposit of high-grade marble, said to equal that of Carrara, Italy, is worked at Marmól, Department of Zacapa. Mica occurs in the Departments of Baja Verapaz and Quiché. Ocher is produced in the Department of Guatemala. Indications of petroleum have been reported from various parts of Guatemala for many years, but no commercial production has as yet developed.

The mineral production of Guatemala, so far as known, is given in the following table:

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[30] Information supplied by the American consulate, Guatemala City.

Mineral production of Guatemala, 1924–1929 [1]

	1924	1925	1926	1927	1928	1929
Cement [2] ....tons	(3)	(3)	(3)	7,673	9,548	13,299
Chromite [4] ....do	----------	----------	54	----------	----------	----------
Gold, crude ....grams	(3)	453,333	512,057	515,011	321,563	265,316
Lead, metallic [5] ....tons	(3)	(3)	67	484	132	152
Mica ....kilograms	[4] 1,343	16,292	12,420	6,677	[6] 13,092	[6] 920
Mineral paint ores: Ocher ....tons	(3)	(3)	345	345	(3)	(3)
Salt ....do	(3)	57	4,805	46	(3)	(3)
Silver ....kilograms	(3)	1,219	3,285	2	(3)	(3)
Stone: Marble [4] ....cubic meters	16	195	(7)	----------	30	----------
Talc ....kilograms	----------	----------	----------	193,194	----------	----------

[1] Data supplied by the American consulate, Guatemala City, except as otherwise noted.

[2] Figures for 1927–1929, inclusive, as published by Dyer, J. E., Cement Markets of the Western Hemisphere—Guatemala: Bur. For. and Dom. Com. Spec. Circ. 5, Washington, 1931.

[3] Data not available.

[4] Imports into the United States.

[5] Content of ores.

[6] Exports.

[7] Quantity not available; value of imports reported as $22.

HAITI

There is no active mining in Haiti. Deposits of asphalt, bitumen, coal (lignite), copper, gold, iron, lead, manganese, and mercury have been reported, but none has been exploited to any extent; and no data on output are available. Salt for domestic consumption is produced by the evaporation of sea water. No production figures are available.

HONDURAS

Deposits of low-grade coal and of copper, gold, iron, petroleum, potassium nitrate, and silver are reported; but the known production is restricted to gold and silver and is virtually represented by the output of the New York & Honduras Rosario Mining Co. This company reports production as follows for 1924 to 1929:

Gold and silver produced in Honduras, 1924–1929, in grams [1]

Metal	1924	1925	1926	1927	1928	1929
Gold	137,664	126,342	181,302	176,792	264,380	320,490
Silver	68,023,033	75,893,800	77,806,664	67,580,182	71,134,625	77,016,076

[1] Annual reports, New York & Honduras Rosario Mining Co.

HUNGARY

Mineral production of Hungary, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Bauxite	192	390	3,667	339,464	395,974	389,152
Briquets, fuel	27,535	32,826	58,851	42,553	56,165	82,289
Coal:						
Bituminous	744,394	805,050	827,710	785,922	783,279	826,270
Lignite	6,342,140	5,518,607	5,822,159	6,244,275	6,510,070	7,043,920
Copper ore	120	155	744	3	----------	----------
Iron:						
Ore	101,750	68,517	132,309	194,400	199,547	251,711
Pig iron	115,502	93,130	189,208	300,237	285,461	367,951
Manganese ore	1,217	3,100	9,909	17,272	22,167	19,044
Pyrite	----------	138	[2] 176	3,666	4,222	1,023
Zinc-lead ore	----------	----------	----------	400	1,000	600

[1] Source of data: Annuaire Statistique Hongrois, Budapest (annual); information furnished by the American consulate, Budapest, except as otherwise noted.

[2] Figures as published by Imp. Inst., London.

ICELAND

Deposits of lignite, iron ore, copper pyrite, Iceland spar, and peat exist in Iceland, and all at some time have been worked to a small extent, but in recent years only spar and peat have been produced. For the years 1924 to 1929, inclusive, the output of spar and peat was reported as follows:[31]

Mineral production of Iceland, 1924–1929

Mineral	1924	1925	1926	1927	1928	1929
Iceland spar.......kilograms..	1, 200	520	----------	----------	----------	----------
Peat..........tons..	25, 000	18, 737	(1)	22, 000	17, 094	20, 640

[1] Data not available.

INDIA (BRITISH)

Mineral production of British India, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Corundum ....tons..	----------	10	28	66	21	35
Garnet sand.........do....	----------	----------	14	290	488	----------
Alum..................do....	47	53	134	72	24	----------
Amber.............kilograms..	4, 521	813	2, 032	3, 607	1, 524	1, 016
Antimony ore...........tons..	----------	10	110	508	376	78
Asbestos................do....	127	16	59	69	159	324
Barite..................do....	2, 340	1, 473	2, 348	1, 747	3, 146	3, 810
Bauxite.................do....	23, 601	10, 232	5, 036	4, 379	14, 902	9, 189
Beryl.............kilograms..	----------	----------	----------	----------	----------	2, 032
Bismuth.................do....	[b] 36	----------	----------	[c] 22	[c] 37	[c] 40
Borax...................do....	----------	----------	([d])	203	762	356
Chromite...............tons..	46, 192	38, 053	33, 918	58, 125	46, 185	50, 361
Clay....................do....	124, 946	130, 928	195, 933	131, 250	188, 554	369, 667
Coal....................do....	21, 514, 131	21, 239, 892	21, 336, 204	22, 436, 757	22, 904, 685	23, 794, 605
Coke, metallurgical:[e]						
Hard................do....	62, 308	56, 107	30, 104	43, 126	[f] 57, 440	[f] 73, 616
Soft................do....	309, 636	422, 646	523, 941	618, 380	[f] 700, 060	[f] 769, 889
Coke by-products:[f] Ammonium sulphate........tons..	----------	----------	([g])	13, 667	15, 656	17, 849
Copper:						
Matte [h]..............do....	2, 982	8, 158	[i] 11, 625	[i] 12, 063	[i] 11, 154	[i] 11, 484
Refined..............do....	----------	----------	----------	----------	----------	1, 661
Copperas..........kilograms..	----------	397	762	397	152	----------
Cyanite................tons..	228	6, 281	([g])	4, 496	2, 277	3, 676
Fuller's earth..........do....	4, 143	2, 233	3, 511	2, 762	3, 448	25, 273
Gems:						
Beryls.............carats..	----------	----------	1, 293	----------	----------	----------
Diamonds [j]...........do....	67	48	69	113	824	1, 628
Rubies [k]..................	[l] ($134, 177)	[l] ($123, 698)	($39, 153)	($42, 806)	($44, 370)	($61, 770)
Sapphires [k]...............	[l] ($18, 291)	[l] ($7, 485)	($123, 904)	($58, 585)	($19, 917)	($3, 983)
Spinels [k].................	[l] ($1, 126)	[l] ($6, 138)	($6, 175)	($122)	($175)	($126)
Gold, fine..............grams	12, 327, 899	12, 250, 887	11, 948, 667	11, 952, 212	11, 696, 862	11, 317, 605
Graphite................tons..	----------	----------	----------	----------	----------	40
Gypsum..................do....	38, 735	36, 826	35, 026	38, 717	59, 998	53, 572

[a] Source of data: Records of the Geological Survey of India, Calcutta (annual), except as otherwise noted.

[b] Reported as ore.

[c] Reported as native bismuth.

[d] Quantity not reported; value of output, $10.

[e] Coke made at collieries only.

[f] Data as published by Imp. Inst., London.

[g] Data not available.

[h] Copper ore is produced in India, but production figures are not available.

[i] Average copper content reported as follows: 1926, 41.6 per cent; 1927, 40.3 per cent; 1928, 39.85 per cent; 1929, 39.84 per cent.

[j] Value of output, 1924 to 1928, inclusive, reported as follows: 1924, $8,768; 1925, $5,302; 1926, $10,353; 1927, $16,304; 1928, $23,781; 1929, $18,864. Values converted from pounds sterling to dollars at the average annual rates of exchange published by the Federal Reserve Board.

[k] Values converted from pounds sterling to dollars as stated in footnote j.

[l] The quantities of rubies, sapphires, and spinels, produced are reported as follows for 1924 and 1925: 1924, rubies 53,511 carats, sapphires 37,942 carats, spinels 9,644 carats; 1925, rubies 109,998 carats, sapphires 31,508 carats, spinels 7,531 carats. Values only reported for subsequent years.

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[31] Information supplied by the Director of Mining Operations, Iceland.

Mineral production of British India, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Iron:						
Ore ... tons	1, 468, 510	1, 569, 368	1, 685, 927	1, 876, 375	2, 088, 991	2, 467, 533
Pig iron [m] ... do	895, 646	900, 832	927, 589	1, 163, 523	1, 072, 052	1, 417, 563
Jadeite ... kilograms	133, 609	86, 211	61, 166	113, 136	144, 532	175, 313
Lead:						
Ore ... tons	315, 266	327, 027	368, 736	458, 012	450, 775	472, 154
Metal (smelter product) ... kilograms	52, 589, 732	48, 033, 764	55, 201, 997	67, 025, 770	79, 642, 063	81, 520, 740
Laterite ... tons	704, 652	288, 532	308, 099	383, 919	406, 345	330, 869
Lime ... do	16, 933	13, 640	16, 135	19, 951	25, 592	32, 081
Magnesite ... do	24, 854	30, 095	30, 950	19, 953	24, 798	23, 874
Manganese ore ... do	815, 894	852, 934	1, 031, 218	1, 147, 479	994, 153	1, 010, 237
Mica (exports) [n] ... do	3, 561	5, 065	4, 569	3, 937	4, 850	5, 897
Mineral paint ores: Ocher ... tons	6, 405	5, 381	1, 902	3, 528	6, 252	7, 480
Monazite ... do	632	(o)	65	284	105	183
Nickel speiss [p] ... do	------------	------------	(g)	1, 049	2, 980	3, 114
Oil shale ... do	------------	41	------------	------------	------------	------------
Petroleum, crude . hectoliters	13, 384, 159	13, 158, 563	12, 738, 861	12, 772, 692	13, 900, 858	13, 910, 145
Phosphate rock ... tons	6, 529	[q] 1, 504	[q] 730	[q] 613	[q] 818	[q] 22
Potash, nitrate of (exports) [r] ... tons	8, 520	6, 450	5, 021	6, 250	4, 550	4, 659
Salt:						
Rock salt ... do	192, 274	152, 794	149, 025	173, 489	157, 846	181, 164
Other salt [s] ... do	1, 457, 258	1, 163, 137	1, 516, 026	1, 464, 328	1, 381, 824	1, 555, 367
Silver ... kilograms	165, 135	151, 052	159, 439	187, 392	230, 969	227, 003
Slate ... tons	13, 615	25, 429	8, 311	7, 967	9, 015	55, 030
Soda [t] ... do	12	28	20	13	13	17
Stone:						
Granite and gneiss ... do	428, 766	533, 408	624, 603	1, 152, 112	1, 071, 280	1, 040, 610
Limestone and kankar [u] ... tons	1, 881, 171	3, 158, 605	3, 145, 262	3, 301, 531	3, 232, 936	3, 406, 249
Marble ... do	5, 708	5, 742	5, 097	5, 725	4, 932	5, 893
Sandstone ... do	452, 891	315, 934	293, 236	356, 682	355, 190	643, 789
Serpentine ... do	2	3	1	------------	2	2
Trap ... do	7, 659	23, 464	6, 684	31, 275	109, 284	663, 832
Miscellaneous building stone and road materials ... tons	2, 533, 338	2, 371, 868	2, 619, 361	2, 854, 470	4, 638, 341	3, 781, 395
Talc and soapstone ... do	2, 898	8, 662	9, 829	5, 134	5, 628	7, 333
Tin concentrates ... do	1, 910	2, 345	3, 605	3, 551	2, 825	3, 845
Titanium ore (ilmenite) do	651	333	4, 304	18, 095	25, 713	24, 050
Tungsten ore (wolfram) . do	751	784	1, 508	1, 179	[v] 632	1, 370
Zinc concentrates ... do	18, 949	17, 080	49, 618	59, 221	65, 151	59, 373
Zircon ... do	391	585	541	1, 489	869	1, 497

[g] Data not available.

[m] Includes ferro-alloys.

[n] The figures for output are incomplete, and a more accurate picture of the industry is to be obtained from the export figures. Output is reported as follows: 1924, 2,078 tons; 1925, 2,336 tons; 1926, 2,130 tons; 1927, 2,165 tons; 1928, 2,292 tons; 1929, 2,704 tons.

[o] Less than a ton (51 kilograms).

[p] Average nickel content reported as follows: 1927, 24.64 per cent; 1928, 24.8 per cent; 1929, 27.08 per cent. The product also contains from 3 to 4 per cent of cobalt.

[q] Apatite.

[r] Production and equivalent in K_2O estimated as follows: 1924, 8,680 tons, K_2O, 3,472 tons; 1925, 7,300 tons, K_2O, 3,000 tons; 1926, 5,800 tons, K_2O, 2,000 tons; 1927, 6,900 tons, K_2O, 3,000 tons; 1928, 4,800 tons, K_2O, 2,000 tons; 1929, 4,900 tons, K_2O, 2,000 tons. (Imp. Inst., London.)

[s] Includes the following quantities produced in Aden: 1924, 182,058 tons; 1925, 191,518 tons; 1926, 197,646 tons; 1927, 184,674 tons; 1928, 226,346 tons; 1929, 250,195 tons.

[t] Exclusive of "trona," the salts obtained by evaporation from Lonar Lake in the Central Provinces, consisting in large part of sodium carbonate, sodium bicarbonate, and sodium chloride, the production of which is reported as follows: 1924, 20 tons; 1925, 36 tons; 1926, 102 tons. There was no production in 1927, 1928, and 1929.

[u] Kankar is a concretionary limestone used for making roads in India.

[v] Exclusive of 221 tons of low-grade complex wolfram-scheelite-cassiterite ore recovered from mine dumps of Mawchi, Southern Shan States, Burma.

INDO-CHINA

Mineral production of Indo-China, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Briquets, fuel ……tons	76, 211	89, 820	97, 456	119, 700	103, 518	113, 225
Cement, Portland ……do	123, 700	147, 900	139, 200	149, 200	159, 200	183, 800
Chromite ……do	20	------	------	------	------	11
Coal:						
Anthracite ……do	1, 170, 570	1, 309, 571	1, 246, 632	1, 444, 900	1, 913, 632	1, 902, 419
Bituminous ……do	60, 745	47, 660	38, 029	38, 000	40, 466	38, 891
Lignite ……do	4, 565	5, 739	5, 598	7, 000	15, 472	30, 713
Coke, metallurgical ……do	------	1, 153	2, 565	([2])	2, 500	637
Gems:						
Sapphires ……carats	4, 144	5, 240	3, 237	3, 080	2, 631	2, 232
Rubies ……do	24	------	------	------	------	------
Gold [3] ……kilograms	11	11	10	10	8	16
Graphite ……tons	2, 264	[4] 221	[4] 815	[4] 410	------	------
Lead:						
Ore [5] ……do	87	157	118	([2])	282	78
Metal (smelter product) ……kilograms	------	------	1, 100	4, 000	10, 000	17, 000
Phosphate rock ……tons	12, 461	30, 236	14, 511	20, 700	19, 629	19, 600
Salt, sea salt (exports) [6] ……do	4, 251	5, 955	20, 456	27, 701	35, 816	25, 636
Silver [3] ……kilograms	------	------	------	316	1, 654	99
Tin:						
Ore [7] ……tons	620	806	830	[8] 1, 278	[8] 1, 199	1, 305
Metal (smelter product) ……tons	334	328	333	313	262	314
Tin-tungsten ore [9] ……do	198	180	182	([8])	([8])	205
Tungsten concentrates [10] ……tons	132	163	149	190	156	172
Zinc:						
Ore [11] ……do	42, 451	52, 869	61, 833	55, 060	51, 619	47, 431
Metal (smelter product) ……kilograms	72, 000	1, 158, 000	1, 858, 300	1, 170, 000	2, 887, 000	3, 808, 000
Zinc oxide ……tons	42	------	------	------	------	------

[1] Source of data: L'Industrie Minière en Indochine, Hanoi (annual); data furnished by the Ingénieur en Chef des Mines, Indo-China; other sources as noted.

[2] Data not available.

[3] Figures as published by the Director, U. S. Mint.

[4] Concentrates.

[5] Average lead content reported as follows: 1924, 47.04 per cent; 1925, 45.12 per cent; 1926, 48.18 per cent; 1927 and 1928, data not available.

[6] Figures as published by the Imp. Inst., London. For the years 1928 and 1929 production is reported as follows: 1928, 161,200 tons; 1929, 255,100 tons. Production data not available for prior years.

[7] Average content reported as follows: 1924, tin, 66.87 per cent; 1925, tin, 66 per cent; 1926, tin, 65 per cent; 1927, tin, 56 per cent; WO_3, 10 per cent; 1928, tin, 67.47 per cent, WO_3 not stated; 1929, tin 59 per cent.

[8] Some tin-tungsten ore included with tin ore.

[9] Average content reported as follows: 1924, tin, 36 per cent, WO_3 36 per cent; 1925, tin, 33 per cent, WO_3 33 per cent; 1926, tin, 58 per cent, WO_3 58 per cent; 1927 and 1928, see under tin ore; 1929, tin, 35.37 per cent, WO_3 35.36 per cent.

[10] Average content of WO_3 reported as follows: 1924, 65.90 per cent; 1925, 66.87 per cent; 1926, 66.44 per cent; 1927, 66.84 per cent; 1928, 67.31 per cent; 1929, 69.19 per cent.

[11] Average zinc content reported as follows: 1924, 42.93 per cent; 1925, 39.33 per cent; 1926, 40.52 per cent; 1927, 39.59 per cent; 1928, 41.62 per cent; 1929, 39.55 per cent.

IRAQ

Mineral production of Iraq, 1925–1929, in tons [1]

Mineral [2]	1925	1926	1927	1928	1929
Asphalt [3]	([4])	([4])	([4])	([4])	5, 100
Petroleum	------	------	45, 000	95, 047	120, 896
Salt [3] [5]	4, 072	5, 015	5, 791	6, 251	7, 803

[1] Source of data: Information supplied by the American consulate, Baghdad, Iraq; publications of the Imp. Inst., London. No production data for 1924 available.

[2] In addition to the minerals listed, coal of poor quality and gypsum are produced in negligible quantities, but no figures of output are available. The principal coal workings are near Kifni, in the Kirkuk district. Gypsum is widely distributed in Iraq and is calcined for mortar.

[3] Figures for year ended Mar. 31 of year following that stated.

[4] Production reported, but no figures available.

[5] Salt issued by the Government for sale.

IRISH FREE STATE

Deposits of barite, clay, coal, copper, ocher, peat, phosphate rock, quartz, silver-lead, slate, and various building stones are known in the Irish Free State; the only figures of production available for the period under review relate to barite and coal. The output of these minerals is reported as follows: Barite, 1929, 41 tons; coal, 1926, 79,715 tons, 1929, 86,554 tons.

ITALY

Mineral production of Italy, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Diatomite tons	420	420	1,200	700	1,180	1,305
Grindstones do	860	1,040	1,020	1,010	960	1,610
Honestones do	517	782	930	1,050	865	805
Millstones do	2,300	2,470	2,815	1,680	1,132	202
Pumice do	31,094	47,900	45,308	36,180	27,500	53,228
Alumina:						
Calcined do	------	1,037	2,550	2,636	2,787	2,287
Hydrated do	------	195	------	------	------	------
Aluminum do	2,058	1,881	1,929	2,544	3,618	7,373
Alunite do	852	1,500	1,600	800	185	105
Antimony:						
Ore [2] do	1,493	1,823	2,613	1,729	1,498	2,070
Oxide do	50	75	86	74	38	56
Regulus do	175	156	174	140	179	173
Sulphide, liquated do	160	121	133	55	69	48
Arsenic ore [3] do	147	4	200	81	------	------
Asbestos:						
Asbestos rock do	(4)	(4)	132,000	350,850	400.000	220,000
Fiber do	2,160	2,105	2,900	3,840	4,950	2,847
Asphalt and bituminous rock tons	186,581	272,990	312,790	356,154	242,300	219,584
Barite do	39,568	32,195	31.845	30,677	27,116	25,955
Bauxite do	140,790	195,000	90,500	95,300	162,229	192,774
Bitumen, crude do	663	678	735	791	2,178	919
Boric acid do	2,695	3,636	3,655	3,592	3,744	4,790
Carbon dioxide, compressed tons	------	84	120	135	878	870
Cement do	(4)	(4)	(4)	(4)	3,048,818	3,192,858
Clay:						
For brick, tile, and pottery tons	6,345,100	7,392,200	7,219,600	7,480,300	6,849,100	7,786,800
For cement do	------	------	------	------	------	58,500
Kaolin and kaolinic earth do	34,185	20,713	19,894	20,595	28,177	31,474
Coal:						
Anthracite do	11,825	14,302	15,708	16,839	10,487	14,232
Bituminous do	115,160	174,220	193,552	151,689	117,445	209,116
Lignite do	917,491	1,105,474	1,181,342	912,458	697,033	782,045
Coke, metallurgical do	309,971	512,264	591,528	578,445	636,399	791,607
Coke by-products:						
Ammonium sulphate tons	4,023	7,882	9,215	9,281	7,332	10,002
Benzol do	400	1,139	1,414	1,832	3,994	5,899
Tar, crude do	7,204	18,412	16,011	18,458	21,801	28,578
Copper:						
Ore [5] do	6,840	10,120	13,346	13,566	8,596	11,721
Ingots kilograms	10,000	578,000	420,000	450,000	900,000	539,000
Cement copper tons	444	498	267	824	2,178	3,064
Feldspar do	5,200	3,400	5,878	4,054	4,960	6,800
Fluorspar do	6,831	7,770	6,320	5,577	4,520	5,740
Gold:						
Ore [6] do	1,500	2,100	1,980	2,200	3,250	4,820
Gold, crude grams	47,600	59,700	53,600	52,700	58,000	48,150
Graphite tons	7,740	9,937	9,605	8,395	7,030	[7] 7,470
Gypsum:						
Alabaster do	12,654	12,554	14,535	13,291	13,177	14,525
For calcining do	564,758	624,450	601,485	587,270	561,450	577,900
For other uses do	22,528	36,528	39,528	73,370	65,960	91,330
Ichthyol do	48	52	25	18	13	12
Ichthyolic shale do	450	3,600	7,120	7,200	5,828	6,900
Iodine, crude kilograms	------	------	4,000	3,625	156	11,028
Iron:						
Ore tons	218,726	495,905	504,556	503,290	625,488	715,171
Pig iron [8] do	341,317	536,245	558,509	529,489	554,113	726,544

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[1] Source of data: Relazione sul Servizio Minerario, Rome (annual).

[2] Average antimony content reported as follows: 1924, 31.15 per cent; 1925, 21.41 per cent; 1926, 17.21 per cent; 1927, 20.60 per cent; 1928, 19.13 per cent; 1929, 18.52 per cent.

[3] Average arsenic content reported as follows: 1924, 22.17 per cent; 1925, 25 per cent; 1926, 17.50 per cent; 1927, 25 per cent.

[4] Data not available.

[5] Average copper content reported as follows: 1924, 5.50 per cent; 1925, 4.22 per cent; 1926, 4.62 per cent; 1927, 3.74 per cent; 1928, 3.15 per cent; 1929, 3.28 per cent.

[6] Average gold content per ton reported as follows: 1924, 31.7 grams; 1925, 30 grams; 1926, 29 grams; 1927; 26 grams; 1928 and 1929, 22 grams.

[7] Includes small quantity of anthracitic graphite.

[8] Includes ferro-alloys.

Mineral production of Italy, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Lead:						
Ore—						
Argentiferous [9] tons	38,564	48,203	51,587	52,834	53,089	51,354
Nonargentiferous [10] tons	2,314	3,159	2,169	2,611	2,280	2,142
Metal (smelter product) kilograms	22,062,000	24,475,000	23,590,000	23,774,000	21,220,000	22,650,000
Lead-zinc sulphide ore [11] tons	4,134	3,512	17,002	2,111	350	30
Leucite rock do	15,600	226,000	35,000	29,000	39,200	37,727
Lithographic stone do	800	575	180	180	180	170
Magnesite do	13,436	14,146	19,842	16,304	11,690	17,172
Magnesium sulphate do	1,700	300	------	------	37	120
Manganese ore do	12,189	14,984	14,010	9,764	10,274	9,917
Manganiferous iron ore do	18,942	17,345	18,230	17,550	15,600	6,838
Marl, for cement do	3,477,456	4,294,900	4,299,250	3,821,029	3,022,633	3,067,970
Mercury:						
Ore [12] do	[13] 200	217,152	228,424	239,334	244,649	239,631
Metallic mercury do	1,641	1,834	1,871	1,996	1,988	1,998
Mineral oil [14] do	2,420	2,400	3,305	3,780	1,398	2,630
Mineral paint ores (ocher, umber, etc.) tons	9,412	10,063	13,359	7,061	8,260	10,852
Molybdenite [15] kilograms	500	------	500	3,000	------	------
Natural gas cubic meters	6,700,000	6,933,800	5,940,000	5,847,600	6,397,240	6,998,322
Nickel ore [16] tons	30	200	------	------	------	------
Oil shale do	2,987	2,700	3,080	4,890	1,560	1,331
Peat do	83,441	90,191	88,956	28,960	6,308	8,066
Petroleum, crude do	5,212	7,896	5,405	6,138	5,994	5,886
Puzzolan, broken lava, and scoria tons	998,100	1,355,000	1,500,000	1,490,000	1,480,000	1,755,000
Pyrite:						
Cupreous [17] do	48,144	39,931	65,741	83,205	36,011	33,153
Iron do	467,637	493,806	528,738	542,133	522,379	631,390
Quartz do	57,695	71,270	80,330	63,735	81,980	81,090
Refractory materials do	64,180	72,000	98,790	79,690	84,310	81,280
Salt:						
Rock salt do	56,896	63,984	67,610	66,850	67,187	63,039
From springs do	152,505	215,129	237,526	298,154	274,506	284,824
From sea water do	597,919	636,524	461,116	685,970	561,695	562,586
Sand, gravel, and silica do	3,061,300	3,835,511	4,125,550	4,108,023	4,059,588	5,104,087
Silver, in bars kilograms	15,458	9,977	16,154	16,603	15,984	16,133
Slate tons	19,112	20,420	19,070	19,590	18,650	19,900
Sodium sulphate do	2,300	1,600	700	780	------	------
Stone:						
Dolomit do	54,000	66,100	61,000	52,200	88,000	94,200
Granite do	71,104	254,503	349,160	179,220	212,018	159,650
Lava do	1,058,100	830,000	848,000	861,000	886,000	865,000
Limestone—						
For lime do	1,834,980	2,140,400	1,958,980	2,161,400	2,425,447	2,430,420
For other uses do	5,405,980	4,957,800	5,314,620	5,368,450	5,367,118	4,834,580
Marble—						
White do	399,994	499,149	534,230	505,817	468,692	462,150
Colored do	68,404	78,491	99,892	116,630	114,531	123,301
Dust do	15,960	2,000	3,000	3,000	3,000	3,250
Sandstone do	514,768	568,133	603,733	583,973	633,080	718,310
Tuff—						
Calcareous do	------	1,992,450	2,225,255	2,001,070	1,937,226	1,933,470
Volcanic do	1,047,700	2,300,000	3,450,000	2,995,000	2,421,000	2,378,000
Other stone do	515,892	797,795	902,780	1,106,310	1,185,178	1,130,610
Sulphur:						
Rock—						
Crude mined do	1,927,906	1,774,275	1,773,270	1,937,110	1,930,140	2,172,290
Ground do	22,300	27,251	33,619	23,864	31,549	21,488
Crude sulphur do	294,899	263,591	271,393	305,716	296,107	323,835
Talc and soapstone do	32,208	33,662	43,075	32,940	33,030	40,810
Tin, ingots do	60	65	80	90	113	120

[9] Average metal content per ton reported as follows: 1924, Pb, 57.09 per cent, Ag, 318 grams; 1925, Pb, 53.35 per cent, Ag, 324 grams; 1926, Pb, 53.34 per cent, Ag, 405 grams; 1927, Pb, 53.70 per cent, Ag, 422 grams; 1928, Pb, 56.66 per cent, Ag, 444 grams; 1929, Pb, 56.70 per cent, Ag, 362.34 grams.

[10] Average lead content reported as follows: 1924, 71.24 per cent; 1925, 70.28 per cent; 1926, 66.15 per cent; 1927, 69.45 per cent; 1928, 66.75 per cent; 1929, 64.32 per cent.

[11] Average metal content reported as follows: 1924, not stated. 1925: Pb, 16.12 per cent; Zn, 9.43 per cent; Cu, 0.06 per cent; Ag, 200 grams. 1926: Pb, 14.14 per cent; Zn, 19.63 per cent; Cu, 0.96 per cent; Ag, 245 grams. 1927: Pb, 11.40 per cent; Zn, 13 per cent; Cu, 2.10 per cent; Ag, 560 grams. 1928: Pb, 11.10 per cent; Zn, 14.57 per cent; Cu, 3.217 per cent; Ag, 782 grams. 1929: Pb, 20 per cent; Zn, 25 per cent; Cu, 3.217 per cent; Ag, 500 grams.

[12] Average content of mercury reported as follows: 1924, 0.8 per cent; 1925, not stated; 1926, 0.9 per cent; 1927, 0.905 per cent; 1928, 0.868 per cent; 1929, 0.884 per cent.

[13] Figures relate to the mineral district of Rome only; data for other mines not available.

[14] Oil distilled from asphalt, bituminous rock, and oil shale.

[15] Average content of MoS_2 reported as follows: 1924, 90 per cent; 1926, not stated; 1927, 10 per cent.

[16] Average nickel content reported as 3 per cent.

[17] Average copper content reported as follows: 1924 and 1925, 1 per cent; 1926, 1.33 per cent; 1927, 1.37 per cent; 1928, 1.5 per cent; 1929, 1.5 per cent.

Mineral production of Italy, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Zinc:						
Ore [18] ……tons..	151,473	177,085	177,932	222,085	220,319	223,907
Electrolytic zinc……do….	1,718	1,520	2,636	2,366	4,867	9,572
Oxide……do….	1,764	2,310	3,739	3,571	3,391	3,040
Refined zinc……do….	4,241	4,958	5,000	5,001	5,787	6,232
Residues……do….	----------	----------	----------	694	434	373
Zinc dust……do….	----------	430	538	----------	----------	----------
Zinc-lead ore [19] ……do….	855	1,883	3,109	3,753	1,213	730

[18] Average zinc content reported as follows: 1924, 38.49 per cent; 1925, 38.90 per cent; 1926, 39.72 per cent; 1927, 38.20 per cent; 1928, 38.41 per cent; 1929, 38.83 per cent.

[19] Average metal content reported as follows: 1924, Pb, 15.71 per cent; Zn, 19.63 per cent. 1925: Pb, 9.77 per cent; Zn, 22.62 per cent. 1926: Pb, 7.32 per cent; Zn, 22.52 per cent. 1927: Pb, 2.8 per cent; Zn, 7.54 per cent. 1928: Pb, 5.55 per cent; Zn, 12.90 per cent. 1929: Pb, 4.37 per cent; Zn, 12.63 per cent.

JAPAN (INCLUDING CHOSEN, KARAFUTO, AND TAIWAN)

Mineral production of Japan, 1924–1929

State and mineral	1924	1925	1926	1927	1928	1929
JAPAN PROPER [1]						
Abrasives:						
Diatomite……tons..	5,040	4,727	(2)	(2)	(2)	(2)
Garnet sand……do….	3,530	3,540	(2)	(2)	(2)	(2)
Pumice—						
Sand……do….	48,399	50,825	53,898	50,169	77,760	(2)
Volcanic ash……do….	36,127	27,885	21,076	23,549	115,141	(2)
Alunite……do….	10	113	(2)	(2)	(2)	(2)
Antimony ore……do….	42	----------	----------	----------	85	89
Arsenic:						
Ore……do….	7,416	(2)	(2)	(2)	(2)	(2)
White arsenic……do….	3,703	3,485	1,035	1,713	1,829	1,963
Asbestos……do….	621	1,174	(2)	(2)	(2)	(2)
Bismuth, metallic…kilograms..	29,605	26,997	25,694	22,576	32,141	49,923
Cement [3] ……tons..	[4] 1,959,023	[4] 2,273,040	[4] 3,032,451	[4] 3,267,463	3,292,816	(2)
China stone and earths..do….	468,782	451,292	397,516	401,809	379,390	(2)
Chromite……do….	5,362	5,823	7,052	9,782	9,808	9,163
Clay:						
Fire clay……do….	174,005	115,018	(2)	(2)	(2)	(2)
For paper manufacture ……tons..	35,779	48,171	34,029	69,803	39,192	(2)
For brick, tile, etc……do….	284,638	2,435,925	2,446,963	2,516,665	2,669,633	(2)
Coal:						
Bituminous……do….	30,000,499	31,369,538	31,296,168	33,387,160	33,694,298	[5] 34,257,817
Lignite……do….	176,764	169,426	161,134	178,613	121,923	139,031
Coke:						
Natural coke……do….	110,327	89,877	130,381	143,447	165,883	(2)
Metallurgical coke..do….	832,429	[6] 849,202	1,035,409	[6] 1,086,023	1,237,754	(2)
Copper (smelter product) ……kilograms..	63,056,092	66,486,999	67,365,449	66,571,249	68,232,865	75,469,049
Feldspar……tons..	23,427	19,049	(2)	(2)	(2)	(2)
Gems: Agate……kilograms..	3,825	4,429	(2)	(2)	(2)	(2)
Gold……grams..	7,600,286	8,463,405	9,098,554	9,606,956	10,390,463	10,422,092
Graphite……tons..	767	1,010	498	633	442	308
Gravel [7] ……	($2,051,569)	($2,454,484)	($4,605,030)	($5,818,035)	($6,288,729)	(2)
Gypsum……tons..	43,093	58,537	264,989	75,498	68,515	(2)
Iron:						
Ore [8] ……do….	57,922	75,765	130,420	159,005	157,706	178,000
Pig iron [9] ……do….	598,237	695,916	821,326	911,261	1,540,465	1,514,835

[1] Source of data: Japan, Ministry of Commerce and Industry, Statistics of Commerce and Industry. Tokyo (annual); Japan, Ministry of Agriculture, Statistics of Agriculture and Forestry, Tokyo (annual), Imp. Inst., London, except as otherwise noted.

[2] Data not available.

[3] Converted from barrels on the basis of 170.54984 kilograms to the barrel.

[4] Exclusive of certain quantities for which value only is reported. The value of this omitted output is reported as follows: 1924, $27,131; 1925, $325,304; 1926, $3,454; 1927, $11,593. Values converted from yen on the basis of the average annual rates of exchange as published by the U. S. Federal Reserve Board.

[5] Includes natural coke.

[6] Exclusive of a small quantity for which value only is reported. Values reported as follows: 1925, $6,310; 1927, $4,832. For basis of conversion see note 4.

[7] Value converted from yen on the basis stated in note 4.

[8] Figures for 1924 to 1927, inclusive, as reported by J. H. Ellers, assistant commercial attaché, Tokyo, 1928; those for 1928 and 1929 as published by Imp. Inst., London.

[9] Figures as published by Imp. Inst., London, which include pig iron produced at Government and other steel works for conversion into steel.

Mineral production of Japan, 1924–1929—Continued

State and mineral	1924	1925	1926	1927	1928	1929
JAPAN PROPER—continued						
Lead (smelter product) kilograms	2, 941, 434	3, 336, 686	3, 609, 935	3, 393, 947	3, 652, 869	3, 373, 944
Manganese ore tons	7, 585	12, 040	15, 209	27, 560	17, 693	18, 446
Mercury, metallic kilograms	------	------	------	------	461	1, 445
Mica tons	592	1, 082	(2)	(2)	(2)	(2)
Mineral paint ores, Ocher tons	304	297	(2)	(2)	(2)	(2)
Natural gas cubic meters	20, 165, 841	23, 209, 051	22, 320, 105	28, 100, 229	27, 472, 746	28, 684, 100
Petroleum, crude hectoliters	2, 848, 756	2, 953, 816	2, 699, 508	2, 615, 458	2, 922, 522	3, 113, 399
Phosphate rock tons	85, 617	87, 375	108, 569	75, 386	58, 776	14, 573
Platinum, from placers grams	4, 519	5, 873	6, 169	1, 459	3, 105	4, 570
Pyrite (cupreous and iron) tons	220, 456	312, 627	417, 513	506, 089	593, 972	618, 743
Quartz sand do	222, 766	229, 807	144, 682	124, 931	121, 053	(2)
Salt [10] do	637, 169	668, 647	614, 134	619, 138	637, 888	644, 151
Silver kilograms	110, 179	126, 195	139, 252	140, 947	160, 024	160, 604
Slate cubic meters	26, 903	22, 920	(2)	(2)	(2)	(2)
Stone:						
Andesite do	135, 314	152, 596	288, 060	307, 107	306, 081	(2)
Dolomite tons	16, 992	16, 658	(2)	(2)	(2)	(2)
Granite cubic meters	337, 560	355, 588	488, 305	428, 741	497, 760	(2)
Ink-slab stone do	647	677	(2)	(2)	(2)	(2)
Limestone—						
For building do	18, 150	27, 958	(2)	(2)	(2)	(2)
For cement tons	2, 373, 783	2, 460, 694	3, 533, 180	3, 819, 847	4, 807, 942	(2)
Marble cubic meters	2, 442	2, 041	2, 386	3, 327	2, 307	(2)
Quartzite and siliceous rock tons	49, 640	69, 492	(2)	(2)	(2)	(2)
Sandstone cubic meters	134, 472	125, 521	138, 587	146, 219	172, 121	(2)
Serpentine do	970	503	(2)	(2)	(2)	(2)
Tuff do	356, 512	311, 274	313, 197	341, 349	343, 397	(2)
Other stone [7]	($2, 729, 306)	($2, 424, 264)	(2)	(2)	(2)	(2)
Sulphur:						
Rock tons	51, 709	43, 304	47, 292	16, 770	13, 319	15, 087
Refined sulphur do	46, 873	47, 716	47, 775	61, 340	70, 063	65, 464
Talc, soapstone, and agalmatolite tons	41, 867	44, 094	(2)	60, 000	(2)	(2)
Tin (smelter product) do	347	391	545	680	745	802
Tungsten ore do	------	------	18	45	50	56
Zinc:						
Ore [11] do	23, 317	(2)	(2)	(2)	23, 284	(2)
Metal (smelter product) kilograms	14, 068, 785	16, 949, 975	16, 972, 221	17, 497, 747	19, 116, 950	22, 099, 129
CHOSEN [12]						
Alunite tons	------	------	------	3, 639	13, 798	10, 812
Antimony ore do	------	------	21	15	------	------
Arsenic, white do	------	[13] 107	------	------	------	------
Clay: Kaolin do	2, 492	3, 709	2, 459	3, 044	5, 806	8, 724
Coal:						
Anthracite do	399, 415	634, 257	682, 896	392, 323	464, 954	538, 245
Bituminous do				317, 255	350, 863	399, 657
Coke metallurgical [14] do	105, 585	107, 574	119, 338	130, 356	(2)	(2)
Copper:						
Ore do	654	1, 011	1, 723	2, 087	3, 977	3, 935
Metal (smelter product) kilograms	------	423, 675	778, 298	1, 004, 132	607, 459	546, 868
Fluorspar tons	------	------	------	------	950	1, 470
Gold grams	4, 171, 856	4, 692, 525	7, 158, 784	5, 642, 591	5, 175, 236	5, 552, 719
Gold-silver ores and concentrates tons	(2)	16, 740	14, 062	11, 784	14, 733	18, 453
Graphite [15] do	14, 948	14, 078	15, 775	17, 942	22, 479	25, 149
Iron:						
Ore do	309, 443	351, 444	351, 575	483, 996	504, 375	551, 814
Pig iron do	99, 795	101, 933	118, 102	129, 022	148, 652	155, 514

[2] Data not available.

[7] Value converted from yen on the basis stated in note 4.

[10] Figures as published in the Statistical Abstract of Agriculture and Forestry, Tokyo (annual). Data relate to fiscal year ended Mar. 31 of year following that stated and do not include output from salt beds which, although situated on Government beach lands, have no fixed areas.

[11] Output of principal mines only.

[12] Source of data: Information furnished by the Government of Chosen through the American consulate at Keijo (Seoul); publications Imp. Inst., London, and other sources as noted.

[13] Exports.

[14] Produced at Kenjiho foundry. Information supplied by R. S. Miller, American consul general, Seoul.

[15] Exports are reported as follows: 1924, 16,032 tons; 1925, 15,040 tons; 1926, 18,692 tons; 1927, 20,331 tons; 1928, 23,095 tons; 1929, 24,645 tons.

Mineral production of Japan, 1924-1929—Continued

State and mineral	1924	1925	1926	1927	1928	1929
CHOSEN—continued						
Lead:						
Ore tons	(2)	(2)	(2)	1,710	146	24
Metal (smelter product) kilograms	----------	484,914	1,957,653	824,210	718,715	332,980
Mercury ore do	----------	----------	----------	----------	----------	506
Mica tons	23	20	16	35	29	26
Molybdenite do	----------	54	7	30	31	30
Pyrite kilograms	----------	----------	----------	----------	60	60
Salt [16] tons	(16)	(16)	(16)	(16)	135,516	138,000
Silica sand do	73,365	75,906	91,833	93,856	77,766	84,676
Silver kilograms	1,700	1,504	1,571	1,600	1,744	1,702
Stone: Marble tons	----------	----------	----------	----------	----------	270
Sulphide ores [17] do	20,783	17,746	15,595	55	1,860	123
Tungsten concentrates do	(2)	(2)	(2)	5	149	14
Zinc ore do	1,051	3,579	7,107	3,684	5,322	5,109
KARAFUTO [18]						
Coal tons	202,585	254,637	280,250	362,777	548,140	645,715
TAIWAN [19]						
Coal tons	1,506,451	1,704,581	1,794,511	1,857,257	1,583,598	1,530,025
Coke:						
Gas-house do	(2)	742	15,602	(2)	(2)	(2)
Metallurgical do	(2)	13,409				
Copper ore [20] do	23,654	22,001	54,855	68,879	62,501	100,985
Gold grams	269,141	242,325	308,265	457,009	280,328	462,251
Mercury ore kilograms	----------	----------	----------	----------	----------	27,979
Natural gas cubic meters	(2)	(2)	(2)	(2)	4,905,299	4,951,582
Petroleum, crude hectoliters	35,781	37,949	138,594	228,269	168,357	103,003
Salt [21] tons	136,200	138,000	135,232	113,400	134,515	164,357
Silver kilograms	342	361	448	562	365	367
Sulphur:						
Crude tons	1,626	1,839	2,560	273	9	9
Refined do	255	758	600	612	772	475

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[2] Data not available.
[16] Salt is known to be produced, but data of output are not available.
[17] Ores containing gold, silver, copper, lead, and zinc.
[18] Source of data: Financial and Economic Annual of Japan.
[19] Source of data: Information furnished by the Government of Taiwan through the American consulate at Taihoku, except as otherwise noted.
[20] Average copper content reported as follows: 1924, 4 per cent; 1925 and 1926, 3.13 per cent; 1927, 2.01 per cent; 1928, not stated; 1929, 6 per cent. Ore reported to contain also considerable quantities of gold and silver.
[21] Figures as published in Financial and Economic Annual of Japan.

KENYA COLONY AND PROTECTORATE

Mineral production of Kenya Colony and Protectorate, 1926-1929 [1]

Mineral [2]	1926	1927	1928	1929
Abrasives: Corundum kilograms	----------	----------	----------	59
Gold, fine grams	24,230	20,373	21,990	26,282
Gypsum kilograms	----------	----------	----------	109
Lead ore [3] tons	99	54	----------	4
Lime do	(4)	2,792	2,464	1,676
Mica kilograms	----------	----------	540	2,032
Silver, fine grams	16,671	4,323	3,515	4,075
Soda (exports) tons	16,126	57,585	79,511	56,022
Stone: Marble do	----------	56	76	254
Zinc ore do	----------	12	----------	----------

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[1] Source of data: Publications of the Imp. Inst., London; information supplied by the American consulate, Nairobi. No data of production available prior to 1926.
[2] In addition to the minerals listed, copper, diatomite, graphite, iron, and manganese are reported to occur in Kenya, but so far as known there has been no commercial development of these mineral occurrences.
[3] The lead content of the ore is reported as follows: 1926, 58 tons; 1927, 33 tons; 1929, 2 tons.
[4] Data not available.

LATVIA

Mineral production of Latvia, 1924–1929, in tons [1]

Mineral [2]	1924	1925	1926	1927	1928	1929
Cement	(3)	(3)	40,420	30,081	25,000	28,000
Clay [4]	150,000	150,000	150,000	150,000	150,000	150,000
Gypsum [5]	4,305	12,355	21,616	24,463	28,020	26,875
Peat	[4] 2,500	[4] 2,500	2,556	[4] 2,500	[4] 2,500	[4] 2,500

[1] Source of data: Information supplied by the American consulate, Riga; publications of the Imp. Inst., London.

[2] In addition to the minerals listed, small occurrences of bog iron ore, dolomite, marl, and sandstone are reported. The marl and dolomite deposits are worked to supply the 2 cement plants of the country, but no statistics of output are available.

[3] Data not available.

[4] Approximate production.

[5] Exports.

LIBERIA

Liberia has no mineral industry worthy of note. Iron is worked by the natives. Gold in small quantities, tin, copper, zinc, monazite, corundum, lead, bitumen or lignite, and diamonds have been found at various times in the interior but not as yet in paying amounts.[32]

LIBIA ITALIANA (CYRENAICA AND TRIPOLITANIA) [33]

Cyrenaica.—According to official statements, salt and limestone are the only minerals produced in Cyrenaica at present. Numerous marshy zones occur on the western shores of the colony which are favorable to the development of salt and chemical industries. One near Bengazi comprises an area of 750 hectares and produces annually about 10,000 tons of salt; another near the Bay of Carcura contains 2,000 hectares. No figures are available on the output of Carcura. The production of limestone in 1929 was reported as 69,727 cubic meters.

Tripolitania.—Salt, stone, and sulphur are the only minerals known to be produced in Tripolitania. The annual output of salt is estimated to be about 20,000 tons. No figures are available for the production of stone and sulphur.

Large deposits of sodium carbonate are reported near Fezzan, but information is lacking as to any development of the deposits. Sulphur ore is extracted by primitive methods from deposits in the Syrt Desert, principally for use in agriculture and as a medicament for camels. Marble and other building stones are quarried for local use.

LITHUANIA [34]

The peat bogs of Lithuania provide the most important mineral product of the country. The output in 1924 to 1929 is reported as follows: 1924, 77,000 tons; 1925, 77,000 tons; 1926, 71,000 tons; 1927, 80,500 tons; 1928, 67,000 tons; 1929, 85,000 tons. The main consumers of peat in Lithuania are the electrical stations.

Amber has been produced and manufactured in the country since the Middle Ages; but the domestic output of crude amber now averages only about 1 ton a year, and the industry is based largely on imports from Prussia. Crude amber is the property of the State, and the amber gatherers must deliver their harvest to the State's amber depots. Failure to deposit renders the delinquent liable to a charge of embezzlement.

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[32] Statesman's Year Book, London, 1930.

[33] Source of data: Relazione sul Servizio Minerario, Rome; publications of the Imp. Inst., London.

[34] Information supplied by the American consulate, Kovno, Lithuania.

LUXEMBURG

Mineral production of the Grand Duchy of Luxemburg, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Cement.........tons	75,441	72,475	82,627	(2)	(2)	(2)
Iron:						
Ore.........do	5,333,580	6,672,092	7,756,240	7,266,249	7,026,832	7,571,206
Pig iron.........do	2,157,170	2,363,253	2,559,151	2,732,000	2,770,066	2,906,093
Gypsum, crude.........do	29,990	24,951	33,984	7,848	2,506	7,206
Lime:						
Hydraulic.........do	19,440	12,389	22,071	17,645	12,698	31,567
Quicklime.........do		13,875	12,326	10,917	12,428	
Sand, for grinding.........do	(2)	7,155	11,526	10,076	15,870	17,703
Sand and gravel.........cubic meters	71,000	53,827	78,807	78,465	77,883	94,892
Silica (pure quartzite)[3]..tons	(2)	10,076	5,040	2,528	2,242	1,512
Slate:						
Roofing slates...number	12,207,000	10,639,000	9,674,000	13,075,000	14,299,000	12,879,002
Sinkstones.........do	351	239	447	288	240	200
Slabs......square meters	2,523	1,724	1,256	1,728	1,918	1,980
Stone:						
Building stone—						
Crude..cubic meters	(2)	2,840	1,461	1,195	1,663	1,488
Dressed.........do	(2)	830	786	888	1,424	1,453
Calcareous tuff......tons	(2)	95	48	160	140	150
Dolomite—						
Crude.........do	37,054	42,895	33,910	6,958	6,047	50
Fritted.........do	(2)	13,240	17,559	21,736	19,485	20,838
Flagstones..square meters	(2)	420	90	50	20	295
Paving stones...number	1,863,900	2,411,000	2,643,000	2,794,000	3,530,000	3,237,000
Road metal, rubble, etc.........cubic meters	71,404	68,292	63,353	56,357	73,049	88,940
Other stone.........do	94,280	100,661	125,453	152,426	148,168	123,248
Other stone.........square meters	1,050	786	730	421	2,215	3,994

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[1] Source of data: Luxemburg, Administration des Mines, Les Industries Extractives (annual); information furnished by the Administration des Mines through the American consulate, Luxemburg.

[2] Data not available.

[3] Used for production of refractory products.

MADAGASCAR

Mineral production of Madagascar 1924–1929 [1]

[Exports]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Corundum [2].........kilograms	146,940	206,263	120,934	145,045	114,824	41,950
Amazonite.........do	15,811	(3)	(3)	(3)	(3)	(3)
Coal [4].........do	----------	----------	----------	4,505	33,128	26,000
Copper ore.........do	----------	2,700	----------	----------	----------	----------
Gems:						
Class 1—(beryls, sapphires, tourmalines, etc.).........grams	149,318	149,588	155,633	190,699	137,950	147,211
Class 2—(garnets, amethysts, etc.).........grams	3,417,963	939,351	1,051,110	1,373,809	2,436,499	6,281,108
Class 3—(garnets for watch jewels, bearings, etc.).........grams	2,286,253	4,248,825	1,187,000	4,602,800	127,292	405,939
Class 4—(opaque beryls, etc.).........grams	12,925,504	17,898,265	863,850	2,281,000	1,065,657	10,123,500

[1] Source of data: Madagascar, Service des Mines, Rapport sur le Fonctionnement, Tananarive (annual); Bull. économique mensuel, Tananarive; data furnished by the Service des Mines, through the American consulate, Tananarive.

[2] Production reported as follows in kilograms: 1924, 146,940; 1925, 225,900; 1926, 116,747; 1927, 153,608; 1928, 114,559; 1929, 64,700.

[3] Data not available.

[4] Production.

Mineral production of Madagascar 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Gold ..... grams	336, 511	197, 087	196, 965	96, 440	32, 475	27, 542
Graphite [5] ..... tons	11, 556	14, 980	11, 454	14, 329	13, 897	16, 049
Iron ore [4] ..... kilograms	.....	6, 155	550	175	.....	.....
Mica: [6]						
Muscovite ..... do	48, 402	37, 366	23, 326	37, 860	33, 302	28, 855
Phlogopite ..... do	238, 082	229, 851	272, 804	506, 385	601, 960	397, 797
	286, 484	267, 217	296, 130	544, 245	635, 262	426, 652
Phosphate rock [7] ..... tons	749	.....	5, 950	.....	8, 300	12, 500
Platinum [4] ..... grams	.....	.....	.....	.....	74	.....
Stones for industrial uses:						
Crystal rock, clear, for optical use ..... kilograms	16, 874	5, 346	2, 586	1, 425	4, 621	8, 286
Crystal, cloudy or opaque, agate, etc ..... kilograms	132, 679	58, 675	17, 791	62, 840	51, 625	59, 652
Uranium ores:						
Betafite ..... do	4, 956	5, 529	2, 246	158	.....	.....
Euxenite ..... do	1, 200	904	.....	.....	.....	.....
Zircon, for industrial uses ..... kilograms	58, 851	4, 097	268	.....	.....	24, 200

[4] Production.

[5] Production reported as follows, in tons: 1924, 13,047; 1925, 13,005; 1926, 15,903; 1927, 13,958; 1928, 18,000; 1929, 13,797.

[6] Production reported as follows, in tons: 1924, muscovite, 48, phlogopite, 238; 1925, muscovite, 42, phlogopite, 246; 1926, muscovite 27, phlogopite, 303; 1927, muscovite, 44, phlogopite, 461; 1928, muscovite, 42, phlogopite, 819; 1929, muscovite, 31, phlogopite, 349.

[7] Production reported as follows, in tons: 1924, not stated; 1925, 449; 1926, 6,135; 1927, 6,480; 1928, 8,450; 1929, 13,441.

MAKATEA ISLAND (FRENCH OCEANIA)

The mining of phosphate rock on the island of Makatea, one of the Tuamotu group, about 100 miles north of Tahiti, is the only mineral industry reported in French Oceania. The exports, which practically represent production, were as follows from 1924 to 1929:[35] 1924, 89,611 tons; 1925, 81,061 tons; 1926, 127,177 tons; 1927, 135,666 tons; 1928, 136,306 tons; 1929, 242,990 tons.

MALAY STATES

FEDERATED STATES

Mineral production of the Federated Malay States, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Coal ..... tons	378, 778	414, 634	471, 736	470, 432	565, 523	672, 131
Gold, fine ..... grams	465, 308	441, 203	450, 223	365, 715	581, 417	883, 013
Stone for road making, etc ..... tons	448, 126	476, 058	390, 548	650, 234	1, 016, 127	700, 306
Tin: [b]						
Tin in concentrates ..... do	37, 900	39, 187	41, 096	49, 173	59, 962	67, 107
Block tin ..... do	6, 850	7, 476	5, 588	3, 844	2, 966	1, 010
Tungsten concentrates: [b]						
Scheelite ..... do	91	27	41	.....	.....	284
Wolframite ..... do	8	134	50	20	5	45

[a] Source of data: Federated Malay States, Report on the Administration of the Mines Department and on the Mining Industries, Kuala Lumpur (annual).

[b] Exports.

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[35] Information supplied by the American consulate, Tahiti.

STRAITS SETTLEMENTS

Mineral production of the Straits Settlements, 1924–1929, in tons [1]

Settlement and mineral	1924	1925	1926	1927	1928	1929
Christmas Island: Phosphate rock (exports) [2]	127,166	111,835	131,057	118,553	113,687	119,756
Labuan: Coal mined [3]	10	41	----------	----------	----------	----------
Other Settlements: Tin, content of ores mined [4]	4	6	2	69	46	3

[1] The Straits Settlements are the center of the great tin-smelting industry of the Malay Peninsula. The smelters are at Singapore and Penang. The only other mineral industry of note is the mining of phosphate rock on Christmas Island.

[2] Data for 1924–1926, inclusive, furnished by the Eastern & Russian Trading Co. (Ltd.), London; those for 1927 and 1929, by the Technical Advisory and Research Bureau (Ltd.), London, through the American consulate, London.

[3] Data furnished by the American consulate, Singapore.

[4] Figures as published by the Imp. Inst., London.

UNFEDERATED STATES

Mineral production of the Unfederated Malay States, 1924–1929 [1]

State and mineral	1924	1925	1926	1927	1928	1929
Johore:						
China clay ..... tons	81	91	251	838	1,001	753
Iron ore ..... do	238,892	276,358	254,100	416,548	654,981	755,138
Tin concentrates ..... do	1,433	1,402	1,056	991	1,114	942
Kedah: [2] [3]						
Tin ore and concentrates ..... do	496	392	338	344	402	378
Tungsten concentrates: Wolfram ..... tons	120	180	100	98	32	75
Kelantan: [2]						
Gold ..... grams	638	638	----------	----------	----------	----------
Tin concentrates ..... tons	----------	1	(4)	(4)	4	2
Perlis: [2] [3]						
Tin ore and concentrates ..... do	529	340	406	367	67,112	566
Trengganu: [2]						
Iron ore ..... do	----------	----------	----------	----------	26,343	55,693
Ferruginous manganese ore [5] ..... do	----------	7,812	77,688	49,284	75,979	32,700
Tin ore and concentrates ..... do	853	978	775	1,184	1,578	1,361
Total:						
China clay ..... do	81	91	251	838	1,001	753
Ferruginous manganese ore [2] ..... do	----------	7,812	77,688	49,284	75,979	32,700
Gold [2] ..... grams	638	638	----------	----------	----------	----------
Iron ore ..... tons	238,892	276,358	254,100	416,548	681,324	810,831
Tin ore and concentrates [6] ..... do	3,311	3,113	2,575	2,886	70,210	2,307
Tungsten concentrates: Wolfram [2] ..... tons	198	258	221	157	135	147

[1] Source of data: Information on the several States furnished as follows: Johore, by the Warden of Mines, Johore; Kedah, by the Superintendent of Mines, Kedah, through the American consulate, Singapore; Kelantan, Perlis, and Trengganu, by the British advisers to the respective States, through the American consulate, Singapore.

[2] Exports.

[3] Period covered represents the Mohammedan year, which is as follows for the years under discussion: 1924, Aug. 14, 1923–Aug. 1, 1924; 1925, Aug. 2, 1924–July 1, 1925; 1926, July 2, 1925–June 30, 1926; 1927, July 12, 1926–July 1, 1927; 1928, July 1, 1927–May 21, 1928; 1929, June 20, 1928–May 11, 1929.

[4] Less than half a ton, that is, 484 kilograms.

[5] Manganese content reported as follows: 1925, 21.86 per cent; 1927, 25 per cent. Data for other years not available.

[6] The total tin content of the concentrates exported from the Unfederated Malay States is reported as follows: 1924, 2,044 tons; 1925, 2,180 tons; 1926, 1,801 tons; 1927, 2,080 tons; 1928, 2,723 tons; 1929, 2,363 tons.

MALTA

Mineral production of Malta, 1928–1929 [1]

Mineral	1928	1929
Lime ..... tons	15,000	16,000
Limestone:		
Globigerina ..... cubic meters	320,000	330,000
Coralline ..... do	56,700	51,600
Salt ..... tons	587	482

[1] Source of data: Information supplied by the American consulate, Valetta, Malta. No data of production available prior to 1928.

MAURITIUS

The only mineral industry reported for the island of Mauritius is the production of salt by evaporation of sea water. The average annual output is estimated at 1,500 tons.[36]

MEXICO

Mineral production of Mexico, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Antimony:						
Ore [b] ......tons..	(c)	3, 374	6, 072	7, 443	8, 272	(d)
Crude antimony [e] ......kilograms..	------------	------------	------------	------------	11, 764	(d)
Ingots [e] ......do....	------------	------------	1, 339, 000	1, 067, 215	2, 175, 803	(d)
Arsenic, white ......do....	3, 401, 000	7, 506, 937	6, 444, 935	11, 332, 222	12, 933, 000	[f] 9, 664, 587
Cadmium ......do....	------------	------------	------------	90, 774	353, 544	640, 968
Coal ......tons..	1, 226, 696	1, 444, 498	1, 309, 138	1, 031, 308	1, 022, 475	1, 054, 196
Copper:						
Ore [g] ......do....	(d)	(d)	1, 730, 521	1, 782, 972	1, 791, 572	(d)
Blister, ingots, and bars ......kilograms..	34, 356, 000	34, 589, 000	37, 982, 000	39, 248, 000	46, 865, 000	[h] 57, 874, 000
Fluorspar ......tons..	(d)	------------	937	(d)	(d)	(d)
Gold, fine ......grams..	24, 647, 000	24, 541, 000	24, 033, 000	22, 556, 000	21, 745, 000	20, 367, 000
Graphite, amorphous ...tons..	8, 023	6, 264	4, 435	6, 818	5, 257	5, 721
Iron:						
Ore ......do....	52, 448	127, 492	92, 982	64, 000	80, 293	112, 749
Pig iron [i] ......do....	19, 485	49, 373	61, 796	40, 415	49, 442	[j] 60, 230
Lead:						
Ore [k] ......do....	(d)	(d)	1, 707, 674	1, 857, 078	1, 690, 143	(d)
Work lead ......kilograms..	133, 440, 000	163, 242, 000	182, 886, 000	230, 782, 000	227, 860, 000	233, 154, 000
Manganese ore ......tons..	1, 800	3, 333	3, 299	861	661	249
Mercury:						
Ore ......kilograms..	(d)	(d)	(d)	(d)	[l] 1, 784, 000	(d)
Metallic mercury ...do....	36, 665	38, 721	45, 416	81, 115	87, 419	82, 636
Molybdenum concentrates ......kilograms..	3, 825	1, 510	------------	------------	------------	------------
Platinum ......grams..	------------	------------	[j] 933	------------	------------	402
Petroleum, crude ..hectoliters..	222, 066, 139	183, 649, 891	143, 754, 880	101, 942, 356	79, 731, 446	71, 046, 578
Salt [m] ......tons..	(m)	(m)	(m)	(m)	(m)	(m)
Selenium ......kilograms..	213	------------	121	128	------------	148
Silver, fine ......do....	2, 844, 104	2, 889, 962	3, 057, 268	3, 252, 688	3, 375, 966	3, 386, 359
Tin [n] ......do....	8, 849	1, 033	2, 224	------------	1, 881	5, 180
Tungsten concentrates ..do....	------------	------------	------------	------------	------------	10, 319
Vanadium ore [o] ......do....	------------	------------	------------	(d)	27, 000	(d)
Zinc:						
Ore and concentrates [p] ......tons..	58, 599	120, 120	27, 639	279, 624	310, 747	(d)
Ingots ......kilograms..	------------	1, 304, 000	5, 967, 000	6, 432, 000	11, 220, 000	15, 099, 000

[a] Source of data: Mexico, Departamento de Minas, Anuario de Estadística Minera (annual); Departamento de Petróleo, Bol. del Petróleo; data furnished by the American consulate, Mexico; other sources as noted.

[b] Average antimony content reported as follows, in kilograms: 1925, 1,169,168; 1926, 2,228,572; 1927, 2,621,662; 1928, 2,873,794.

[c] Data not available. Antimony produced as a by-product of lead smelting reported as 774,567 kilograms.

[d] Data not available.

[e] Antimony content.

[f] Exports.

[g] Total mine production (copper content of ores, concentrates, etc.) reported as follows, in kilograms: 1924, 50,061,513; 1925, 54,596,160; 1926, 56,347,423; 1927, 59,874,857; 1928, 67,327,828; 1929, 86,553,669.

[h] Figures as published by Metallgesellschaft.

[i] Includes ferro-alloys.

[j] Figures as published by Imp. Inst., London.

[k] Total mine production of lead (lead content of ores, concentrates, etc.) is reported as follows, in kilograms: 1924, 165,062,786; 1925, 178,661,677; 1926, 210,794,394; 1927, 243,346,747; 1928, 236,485,856; 1929, 248,700,000.

[l] Figures are incomplete. Data relate only to output of three mines located, respectively, in the States of Chihuahua, Guerrero, and Jalisco, and do not include ore produced by small operators who report only on the metallic mercury produced by them in primitive smelters.

[m] Salt is produced, but quantity is not reported. Annual output is estimated at approximately 67,000 tons.

[n] Tin content of exports.

[o] Content of V_2O_5 reported as follows, in kilograms: 1927, 1,338; 1928, 2,640; 1929, 806.

[p] Total mine production of zinc reported as follows, in kilograms: 1924, 24,659,158; 1925, 51,794,554; 1926, 105,366,568; 1927, 137,723,905; 1928, 161,747,077; 1929, 174,049,667.

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[36] Source of data: Publications of the Imp. Inst., London.

MOROCCO

French Morocco.—The rich and extensive beds of phosphate rock in the French zone of Morocco have been worked on a large scale since 1921, and so far they have constituted the leading mineral industry of the Protectorate. Other important minerals occur, and their exploitation is increasing. A deposit of anthracite has been discovered in the Djerada Basin 40 kilometers south of Oudjda, and beds of bituminous coals are reported in the basin of the Guir near Kénadsa and in the basin of the Ziz.[37] No output from any of these coal deposits has been recorded as yet.

The mineral production of French Morocco, so far as known, is shown in the following table:

Mineral production of French Morocco, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony ore .... tons..	----------	----------	----------	----------	120	----------
Cement .... do....	29,000	30,000	39,000	43,446	39,100	(2)
Clay, for pottery .... do....	(2)	(2)	(2)	(2)	7,000	(2)
Copper ore .... do....	120	50	[3] 412	----------	----------	----------
Graphite [3] .... do....	----------	----------	----------	----------	----------	104
Iron ore .... do....	----------	----------	----------	1,050	----------	----------
Lead ore [3] .... do....	1,100	1,354	2,695	1,958	6,290	5,069
Lime, hydraulic .... do....	17,000	17,000	23,000	23,678	21,400	(2)
Manganese ore .... do....	(4)	[3] 679	[3] 306	[3] 2,696	[3] 2,144	13,150
Molybdenite [3] .... kilograms..	----------	----------	4,002	3,500	900	700
Phosphate rock [5] .... tons..	461,582	692,181	882,821	1,400,000	[6] 1,337,079	[6] 1,608,249
Salt [7] .... do....	3,000	3,500	1,200	3,600	8,000	8,000
Sand and gravel .... do....	(2)	(2)	(2)	(2)	1,101,000	(2)
Stone:						
Building stone, dressed ... do....	(2)	(2)	(2)	(2)	195,000	(2)
Limestone, for hydraulic lime and cement .... tons..	(2)	(2)	(2)	(2)	60,000	(2)
Stone for ballast, road making, etc .... tons..	(2)	(2)	(2)	(2)	2,580,000	(2)
Talc [8] .... do....	----------	292	478	2	535	610
Tin ore [3] .... kilograms..	----------	2,000	8,149	14,010	8,600	----------
Zinc ore [3] .... tons..	(2)	(2)	99	184	647	2,602

[1] Source of data: Statistique de l'Ind. Min. France et Algérie, Paris (annual); information supplied by the Ministère des Colonies, France, through the American consulate, Paris, and by the American consulate, Tangier; other sources as noted.
[2] Data not available.
[3] Exports.
[4] No exports reported. Production of 400 tons reported.
[5] Data supplied by Office Chérifien des Phosphates, Morocco.
[6] Shipments.
[7] Extracted from Lake Zima.
[8] Exports. Figures as published by Imp. Inst., London, converted to metric tons.

Spanish Morocco.—The three principal mineral districts in the Spanish zone of Morocco [38] are as follows: The eastern region near Melilla; the Gomara Mountain country about 50 miles southeast of Tetuan; and the region between Tetuan and Ceuta in the Anjera Mountains. The principal iron-ore deposits now worked lie in the Melilla district, and some workable lead deposits also are reported. Zinc, lead, copper, and graphite occur in the Gomara district, and remains of old mine workings have been found. In the Tetuan-Ceuta region deposits of coal, copper, iron, and graphite have been reported, and an antimony mine has been in operation for some years.

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[37] Despujols, P., Note sur l'industrie minière au Maroc: Rabat, 1930, 45 pp.
[38] Bigelow, D. F., American consul, Tangier, July 13 ,1931.

The mineral output of Spanish Morocco is reported as follows:

Mineral production of Spanish Morocco, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony ore [2]			162	219	521	417
Iron ore	(3)	800,000	[2] 467,350	[2] 997,111	[2] 1,060,709	[2] 1,061,424
Lead concentrates	(3)	1,500		[2] 761	[2] 514	[2] 1,010
Salt, rock [2]					44	

[1] Source of data: Information supplied by Maxwell Blake, American consul general, Tangier.

[2] Exports.

[3] Data not available.

NAURU AND OCEAN ISLANDS (BRITISH OCEANIA)

The large phosphate rock beds on Nauru and Ocean Islands form the basis of the only mineral industry reported on the islands. The exports during 1924 to 1929, inclusive, for the fiscal year ended June 30 of the year stated were as follows:[39] 1924, 459,162 tons; 1925, 478,278 tons; 1926, 398,059 tons; 1927, 633,345 tons; 1928, 509,970 tons; 1929, 585,844 tons.

NETHERLANDS

Mineral production of the Netherlands, 1924–1929 [a]

Mineral [b]	1924	1925	1926	1927	1928	1929
Briquets, fuel:						
Coal .... tons	562,181	570,717	714,884	662,210	785,829	958,186
Lignite .... do	57,083	68,463	70,256	69,111	69,091	54,498
Coal:						
Bituminous .... do	6,180,182	7,116,970	8,842,687	9,488,412	10,920,054	11,581,202
Lignite .... do	191,202	207,623	211,194	201,382	196,696	156,568
Coke:						
Gas-house [c] .... do	750,000	800,000	800,000	850,000	850,000	850,000
Metallurgical .... do	975,779	1,143,806	1,198,609	1,478,822	1,573,392	2,402,566
Iron:						
Ore .... do				1,000	1,100	900
Pig iron [d] .... do	91,105	109,315	142,504	203,692	258,224	253,776
Salt, rock .... do	32,054	34,053	34,505	40,596	41,858	[e] 45,247
Stone:						
Limestone—						
For building .... cubic meters	3,571	2,552	2,864	4,124	3,531	5,406
For other purposes .... tons	5,020	5,400	1,923	4,712	4,964	12,963
Zinc (smelter product) [f] .... kilograms	18,190,000	21,117,000	24,796,000	26,268,000	26,857,000	25,712,000

[a] Source of data: Jaarverslag van den Hoofdingenieur der Mijneu, The Hague (annual); Jaarcijfers voor Nederland, The Hague (annual), except as otherwise noted.

[b] In addition to the minerals listed, peat is produced in the Netherlands, but annual data of output are not available.

[c] Approximate output, as officially estimated.

[d] Data furnished by the Koninklijke Nederlandsche Hoogovens en Staalfabrieken, the only producer in the Netherlands, through the American consul general, Amsterdam.

[e] Sales.

[f] Data furnished by Cie. Anonyme des Zincs de la Campine, through the American consul general, Amsterdam. The product is made entirely from foreign material, as no zinc ore is mined in the Netherlands.

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[39] Figures for 1924–1928, inclusive, supplied by the British Phosphate Commission through the American consulate, Melbourne, Australia; those for 1929 from World Trade Notes on Chemical and Allied Products, vol. 5, No. 2, U. S. Bur. For. and Dom. Com., Washington, 1931.

NETHERLAND EAST INDIES

Mineral production of the Netherland East Indies, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt rock.............tons..	650	670	155	1, 340	1, 050	15, 030
Briquets, fuel............do....	28, 373	22, 644	96, 159	112, 543	82, 629	64, 099
Cement, Portland......do....	82, 654	100, 402	108, 460	(2)	(2)	(2)
Clay:						
Kaolin..............do....	------------	------------	------------	------------	------------	140
Other clay..cubic meters..	------------	------------	------------	------------	5, 600	9, 820
Coal, bituminous.......tons..	1, 446, 757	1, 400, 725	1, 466, 359	1, 620, 205	1, 703, 526	1, 833, 665
Gems: Diamonds.....carats..	349	667	276	250	236	570
Gold, fine..............grams..	3, 869, 289	4, 147, 053	3, 588, 362	3, 513, 052	3, 430, 255	3, 412, 172
Iodide of copper[3].......tons..	------------	113	135	131	149	190
Lime...................do....	1, 597	2, 513	3, 654	4, 659	92, 539	54, 198
Manganese ore..........do....	8, 482	10, 997	11, 393	18, 503	24, 452	20, 892
Natural gas.............do....	283, 505	412, 109	373, 127	357, 222	479, 503	538, 335
Phosphate rock.........do....	------------	------------	------------	------------	------------	3, 172
Petroleum, crude.......do....	2, 925, 768	3, 066, 074	3, 018, 109	3, 693, 829	4, 307, 716	5, 238, 543
Salt...................do....	131, 860	471, 043	407, 607	264, 197	253, 162	486, 907
Silver, fine........kilograms..	64, 799	75, 172	73, 525	71, 083	63, 203	61, 932
Stone:						
Limestone..........tons..	6, 480	56, 295	32, 697	43, 432	53, 598	200, 382
Tuff........cubic meters..	5, 909	------------	------------	------------	(2)	1, 038
Sulphur.................tons..	------------	55	207	355	370	1, 560
Tin, metallic............do....	31, 090	31, 189	32, 376	33, 863	35, 396	35, 801
Tin-tungsten ore........do....	329	54	18	44	16	21
Trass...................do....	5, 120	18, 251	13, 680	8, 892	(2)	(2)

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[1] Source of data: Jaarboek van het Mijnwezen in Ned.-Indië, Weltevreden (annual); Statistisch Jaaroversicht van Ned.-Indië, Weltevreden (annual).

[2] Data not available.

[3] Exports.

NETHERLAND WEST INDIES

Phosphate rock and marine salt were the only minerals produced in the Netherland West Indies, 1924 to 1929, inclusive. The islands of Aruba and Curaçao formerly produced some gold, but no output of the precious metal has been reported in recent years. The phosphate beds of Aruba, also, have not been worked for some time. The mineral output of the colony in the years under review follows:

Mineral production of the Netherland West Indies, 1924–1929, in tons [1]

[Exports]

Island and mineral	1924	1925	1926	1927	1928	1929
Bonaire: Salt, from sea water..............	2, 620	11, 446	4, 215	4, 193	2, 430	1, 715
Curaçao:						
Phosphate rock........................	100, 471	81, 771	106, 807	108, 881	104, 194	103, 289
Salt, from sea water..................	65	4, 523	853	694	3, 134	----------
St. Martin: Salt, from sea water...........	6, 209	2, 408	5, 091	3, 331	4, 214	2, 962
Total: Phosphate rock..............	100, 471	81, 771	106, 807	108, 881	104, 194	103, 289
Salt, from sea water..........	8, 894	18, 377	10, 159	8, 218	9, 778	4, 677

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[1] Data furnished by the Governor of Willemstad, Curaçao. Figures relate to exports, as statistics of output are not available.

NEW CALEDONIA

Mineral production of New Caledonia, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Chromite [2]	23,021	34,732	34,267	[3] 42,885	56,902	52,594
Coal	----------	1,300	15,000	9,000	16,565	21,000
Cobalt ore [4]	----------	15	----------	79	----------	----------
Gypsum	(5)	15,000	20,000	10,000	15,000	7,116
Manganese ore [4]	93	10	----------	130	----------	----------
Nickel:						
Ore [6]	75,718	86,550	100,364	118,000	117,000	135,473
Ferronickel [7]	----------	----------	----------	163	655	810
Matte [8]	4,042	4,820	5,039	4,428	4,745	5,933
Phosphate rock	[4] 8,169	12,000	[4] 10,647	9,000	7,000	[4] 5,663
Zinc-lead ore [9]	----------	2,000	2,200	1,500	(10)	1,500

[1] Source of data: Statistique de l'Ind. Min. en France et en Algérie, Paris (annual); information furnished by the Governor of New Caledonia; other sources as noted.

[2] Average content of chromic oxide reported as follows: 1924, 52 per cent; 1925, 53 per cent; 1926, 48.79 per cent; 1927, 52 per cent; 1928 and 1929, 53 per cent.

[3] Exports.

[4] Exports. Figures as published by Imp. Inst., London, converted to metric tons.

[5] Data not available.

[6] Average nickel content reported as follows: 1924, not stated; 1925, 6 per cent; 1926, 5.25 per cent; 1927, 5 per cent; 1928 and 1929, not stated.

[7] Average nickel content reported as follows: 1927, 79 per cent; 1928, 80 per cent; 1929, 77 per cent.

[8] Average nickel content reported as follows: 1924, 76 per cent; 1925, 1926, and 1927, 77 per cent; 1928, not stated; 1929, 77 per cent.

[9] Average metal content reported as follows: 1925, Pb, 16 per cent; Zn, 31 per cent; 1926, Pb, 13 per cent; Zn, 29 per cent; 1927, Pb, 15 per cent; Zn, 30 per cent; 1929, Pb, 13 per cent, Zn, 28 per cent.

[10] Operations temporarily discontinued.

NEWFOUNDLAND

Mineral production of Newfoundland, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Coke, gas-house	(2)	1,200	1,000	(2)	(2)	(2)
Copper ore	9	----------	----------	----------	----------	----------
Iron ore [3]	992,972	1,150,169	879,603	1,356,851	1,572,725	1,541,334
Lead ore	----------	234	2	----------	----------	----------
Stone: Limestone	76,976	9,000	180,972	162,200	250,225	259,886
Zinc-lead ore	----------	----------	----------	----------	34,519	165,732

[1] Information supplied by the Ministry of Agriculture and Mines of Newfoundland, through the American consulate, St. John's; publications of the Dominion Bureau of Statistics, Ottawa.

[2] Data not available.

[3] Shipments from the Wabana mines.

NEW GUINEA, TERRITORY OF

Little mining has been done in the Territory of New Guinea, and knowledge of the mineral resources is scanty. The following minerals have been reported: Coal (lignite), on the mainland and in the southern part of New Ireland; copper, in the form of chalcopyrite and malachite; gold, alluvial deposits and a few quartz veins; iron, hematite and magnetite, apparently in large quantities; lead, in the form of red oxide; mica, in fairly large sheets; osmiridium and platinum; petroleum, known but not yet found in paying quantities; phosphate rock, on the Purdy Islands; and sulphur, in several localities.[40]

The only mineral reported as produced is gold, the output of which, in terms of fine gold, is given as follows for the years ended June 30 of year stated:[41] 1924, 205,812 grams (exports from Morobe field);

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[40] Official Year Book of the Commonwealth of Australia, Melbourne (annual).

[41] Publications, Imp. Inst., London.

1925, 135,300 grams; 1926, 183,500 grams; 1927, 1,431,000 grams; 1928, 1,866,000 grams, 1929, 1,369,000 grams.

NEW ZEALAND

Mineral production of New Zealand, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Pumice [2] ____tons__	1,655	2,573	2,396	1,761	2,338	2,278
Coal:						
Bituminous ________do____	1,102,418	1,061,494	1,215,590	1,311,242	1,370,379	1,389,107
Lignite ____________do____	1,014,224	1,087,447	1,060,361	1,093,484	1,105,483	1,187,458
Gold, fine [3] __________grams__	4,156,389	3,552,266	3,761,748	3,896,520	3,560,758	3,500,448
Iron:						
Ore ______________tons__	2,550	2,620	8,122	6,997	12,929	8,172
Pig iron ___________do____	640	1,310	4,061	3,437	6,464	4,464
Manganese ore [2] _______do____	6	----------	----------	5	----------	----------
Mercury, metallic kilograms__	----------	----------	----------	711	----------	----------
Petroleum, crude ______liters__	31,800	295	4,507	----------	----------	----------
Phosphate rock ________tons__	1,600	----------	----------	----------	----------	----------
Platinum metals:						
Osmiridium, from placers ______________grams__	----------	----------	----------	----------	16	----------
Platinum, from placers ______________grams__	----------	----------	964	1,026	1,089	218
Silica sand ____________tons__	----------	----------	----------	----------	----------	323
Silver [3] __________kilograms__	17,949	15,380	13,211	13,123	13,825	12,930
Stone:						
Building and monument stone ____________tons__	19,482	27,050	74,088	26,686	8,183	7,622
Limestone—						
For agriculture__do____	140,961	136,851	124,142	146,385	185,885	225,315
For cement _____do____	265,145	310,385	362,748	378,453	315,770	328,170
Stone for road making, etc ______________tons__	869,696	973,500	1,088,589	1,164,367	994,450	1,104,745
Other stone ________do____	106,615	58,823	175,759	499,703	273,486	123,710
Sulphur, crude ________do____	----------	273	604	477	731	983
Tungsten concentrates (scheelite) ____________do____	15	31	13	13	5	34

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[1] Source of data: New Zealand, Minister of Mines: Mines Statement, Wellington (annual); Imp. Inst. Statistical Summary, London (annual).

[2] Exports.

[3] Content of exports, exclusive of jewelers' sweepings.

NICARAGUA

Deposits of copper, gold, manganese, mica, petroleum, salt, silver and titaniferous iron ore have at various times been reported in Nicaragua, but the mineral production has been limited to gold and silver. Data on the output of these metals are not available.

NIGERIA

Mineral production of Nigeria, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Coal ______________________________tons__	235,848	242,833	329,784	363,643	365,083	350,473
Gold, fine ___________________________grams__	44,851	31,446	4,137	684	2,675	5,972
Iron ore ____________________________tons__	(2)	(2)	(2)	(2)	(2)	(2)
Lead concentrates [3] _________________do____	----------	(4)	(4)	321	33	72
Salt [5] _____________________________do____	400	400	400	400	400	400
Silver, fine [5] _________________kilograms__	(4)	(4)	(4)	883	87	199
Tin concentrates [6] ________________tons__	8,999	8,696	10,765	11,694	13,255	15,591
Zinc ore [7] _________________________do____	----------	----------	----------	21	126	----------

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[1] Source of data: Publications of Imp. Inst., London; information furnished by the Chief Inspector of Mines, Nigeria, through the American consulate, Lagos.

[2] Small quantities of iron ore are produced from native workings, but no figures of output are available.

[3] The lead content is reported as follows: 1925, 61 tons; 1926, 173 tons; 1927, 257 tons; 1928, 25 tons; 1929, 43 tons.

[4] Data not available.

[5] Approximate production.

[6] Tin content is reported as follows: 1924, 6,300 tons; 1925, 6,356 tons; 1926, 7,536 tons; 1927, 8,185 tons; 1928, 9,279 tons; 1929, 10,906 tons.

[7] Zinc content is reported as follows: 1927, 10 tons; 1928, 61 tons.

NORWAY

Mineral production of Norway, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives (exports):						
Diatomite .... tons	67	48	58	80	84	10
Millstones .... do	180	64	----------	5	2	2
Whetstones .... do	173	146	131	119	150	147
Aluminum .... do	19,953	21,304	24,429	20,847	24,779	29,142
Chromite (exports) .... do	177	440	17	----------	----------	----------
Copper:						
Ore [2] .... do	2,032	4,297	3,903	2,524	15,285	28,569
Metal (smelter product) .... kilograms	71,300	251,000	192,000	13,000	788,000	2,400,000
Feldspar (exports):						
Ground .... tons	4,524	5,120	3,734	4,685	5,990	6,869
Unground .... do	16,351	21,665	16,776	22,965	18,085	19,655
Fluorspar (exports) .... kilograms	----------	5,350	----------	500	----------	2,000
Iron:						
Ore .... tons	522,124	425,424	212,661	328,134	530,508	746,112
Pig iron [3] .... do	64,955	87,931	97,311	110,416	126,598	153,395
Lead (smelter product) .... kilograms	642,000	406,000	385,000	(4)	(4)	(4)
Magnesite, crude .... tons	1,976	1,699	715	1,090	932	1,809
Mica (exports):						
Sheet .... kilograms	120	999	2,380	3,782	2,438	250
Scrap .... do	24,825	22,400	39,539	4,075	82,788	58,550
Molybdenite [5] .... tons	79	153	145	155	216	228
Nickel:						
Ore [6] .... do	----------	----------	----------	7,612	21,246	23,473
Metal (smelter product) .... kilograms	----------	----------	----------	30,000	591,000	438,000
Phosphate rock (apatite) .... tons	345	467	343	----------	----------	----------
Pyrite, cupreous iron .... do	403,411	624,375	634,836	617,044	738,535	739,597
Silver:						
Ore .... do	19,868	19,931	16,314	14,422	14,267	13,922
Silver, fine .... kilograms	13,200	15,700	9,600	9,800	12,400	8,800
Sodium, metallic .... tons	507	497	36	(7)	(7)	(7)
Talc .... do	11,785	9,032	7,608	7,607	7,822	8,332
Tin (smelter product) .... kilograms	----------	----------	----------	(4)	(4)	(4)
Titanium ores:						
Ilmenite [8] .... tons	3,472	4,162	4,200	5,733	7,948	7,923
Rutile [9] .... do	27	52	50	45	59	43
Zinc:						
Ore [10] .... do	1,389	853	165	333	100	3,613
Metal (smelter product) .... kilograms	5,024,000	6,807,000	5,359,000	(4)	(4)	(4)

[1] Source of data: Norges Bergverksdrift, Norges Handel, published annually by the Statistiske Centralbyrå, Oslo.

In reckoning the mineral resources of Norway, those of Svalbard should be taken into account, as the islands of this group are now under the sovereignty of Norway.

[2] Average copper content reported as follows: 1924, 9.49 per cent; 1925, 10.94 per cent; 1926, 8.91 per cent; 1927, 9.12 per cent; 1928, 12.82 per cent; 1929, 16.62 per cent.

[3] Includes ferro-alloys as follows: 1924, 63,478 tons; 1925, 84,495 tons; 1926, 94,056 tons; 1927, 107,054 tons; 1928, 119,218 tons; 1929, 124,536 tons.

[4] Not reported separately. The combined output of lead, tin, and zinc reported as follows: 1927, 6,137 tons; 1928, 382 tons; 1929, 6,433 tons. The American Bureau of Metal Statistics reports 5,488 tons of zinc produced in 1927, no production in 1928, and 5,516 tons in 1929.

[5] Average content of MoS_2 reported as follows: 1924, about 90 per cent; 1925, 78.59 per cent; 1926 and 1927, 80 per cent; 1928 and 1929, 75 to 80 per cent.

[6] Average content of nickel reported as follows: 1927, not stated; 1928, 2.40 per cent; 1929, 1.83 per cent.

[7] Data not available.

[8] Average content of TiO_2 reported as follows: 1924, 38.5 per cent; 1925, 41 per cent; 1926, 41.5 per cent; 1927, 43.6 per cent; 1928, 42.62 per cent; 1929, 43 per cent.

[9] Average content of TiO_2 reported as 90 to 93 per cent.

[10] Average content of zinc reported as follows: 1924, 45.59 per cent; 1925 ,38.33 per cent; 1926, 19.64 per cent; 1927, 32.20 per cent; 1928, 22 pei cent; 1929, 40.02 per cent.

NYASALAND PROTECTORATE [42]

The mineral industry of Nyasaland has not attained commercial importance, but a long list of economic minerals has been reported. The deposits now known include abrasive corundum and garnet, asbestos, barite, bauxite, clay, coal, copper, gold, graphite, gypsum, iron, manganese, mica, monazite, phosphate rock, platinum, silver-lead, strontianite, talc, and tin. The coal of the Lower Shire area and the bauxite of the Mlanje Mountains have attracted the attention of mining interests. The flake graphite of Angoniland, reported to be of excellent quality, and the gold, mica, and corundum of other areas doubtless will become of greater interest as transport facilties improve. Alluvial deposits of gold are widely distributed. Manganese is found in the form of a low-grade manganiferous iron ore. No production data are available.

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[42] Source of data: Nyasaland Protectorate, Geol. Survey Dept., Annual Repts.; Dixey, F., Geology and Mineral Resources of Nyasaland: London, 1926, 14 pp.; Bauxite Deposits in Nyasaland: Min. Mag., vol. 33, No. 4, London, 1925, pp. 201-205.

PALESTINE (INCLUDING TRANS-JORDAN) [43]

Deposits of alum, asphalt, bitumen, copper, gypsum, iron, manganese, petroleum, phosphate rock, salt, sulphur, and talc are reported in Palestine and Trans-Jordan, but the only available figures of production relate to gypsum and salt.

Apparently the Dead Sea offers the greatest potential source of mineral production in the country, as recent chemical analyses indicate that in addition to salt its waters contain very large quantities of such mineral salts as the chlorides of potassium, sodium, magnesium, and calcium, and also bromide of magnesium. The experimental stage in the extraction of the salts is safely passed, and operations are well under way, but production figures are not yet available.

Asphalt occurs in considerable quantities around the south end of the Dead Sea in gravels, limestone, and sandstone, but possibility of extraction on a commercial scale is believed to be limited. Bitumen of very pure quality comes ashore in limited quantities along the western and southern coasts of the Dead Sea after heavy weather. The product was formerly used for varnish making but is now used principally in electrical insulation. Bituminous limestone is found throughout Palestine, the beds of the Yarmouk Valley being the most extensive. The petroliferous areas of the country are now believed to be concentrated largely around the Red Sea, particularly in the vicinity of the Gulf of Akaba. Test drillings have been made from time to time, but no commercial production of petroleum has been reported.

The copper and manganese deposits near the Gulf of Akaba are said to be large and are now being actively prospected. Copper is also found north of Gaza and near Fenan in Trans-Jordan. Numerous occurrences of highly ferruginous minerals are known in Palestine, but the best-known iron mine is at Tel-Ekweder in Trans-Jordan. This deposit, although long neglected, has prospects of development.

The existence of alum deposits south of Gaza has been known for a long time; but when the beds were opened the alum was found to be much less important than the extensive sulphur deposits revealed. Gypsum is distributed widely throughout the country, but the Melhamia deposit is at present the only one worked commercially. Three fields of phosphate rock are known, that of Es-Salt being the most important. Rock salt occurs principally at Jebel Usdum on the Dead Sea, and sea salt is produced near Haifa. Talc has been found on the El-Lissan Peninsula.

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[43] Information supplied by the American consulate, Jerusalem; Picard, L., Geological Researches in the Judean Desert: Jerusalem, 1931, 108 pp.

The production of gypsum and salt is reported as follows:

Gypsum and salt produced in Palestine, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Gypsum		1,000		1,158	1,341	1,499
Salt:						
Rock salt					1,654	2,508
Sea salt	2,600	5,600	6,279	7,014	(2)	5,233

[1] Source of data: Information supplied by the American consulate, Jerusalem; publications of the Imp. Inst., London.

[2] Data not available.

PANAMA

The only mineral reported as produced in Panama during the period under review is salt, which is evaporated from sea water. The average annual output is about 1,000 tons.

The Section of Mines, Department of Agriculture and Public Works, Republic of Panama, reports the known mineral deposits of the Republic, distributed by Provinces, as follows:

> Asbestos—in Coclé; copper—in Bocas del Toro, Chiriqui, Coclé, Darien, Herrera, Los Santos, and Veraguas; gold—in Bocas del Toro, Chiriqui, Colón, Darien, Herrera, Los Santos, Panamá, and Veraguas; iron—in Colón; manganese—in Colón and Herrera; petroleum—in Chiriqui; silver—in Bocas del Toro, Colón, Darien, Panamá, and Veraguas; sulphur—in Coclé.

Coal is also reported [44] in the Province of Colón. Limestone is plentiful, and lime is produced in small quantities.

PAPUA

Mineral production of Papua, 1924–1929 [1] [2]

Mineral	1924	1925	1926	1927	1928	1929
Copper:						
Ore [3] ..... tons				52	16	
Blister [4] ..... do		90	176			
Matte [3] [5] ..... do	8	2,038	7,138	540		
Gems: Pearls [3] ..... carats	15,912	12,962	17,227	18,001	2,192	4,962
Gold, fine ..... grams	49,050	129,111	198,565	191,193	51,227	69,299
Osmiridium ..... do	[3] 3,701	[3] 3,608	[3] 1,524	1,866	6,687	902
Silver, fine ..... kilograms	(6)	(6)	(6)	155	(6)	(6)

[1] Source of data: Territory of Papua, Annual Report; information furnished by the Director of Mines, Territory of Papua, through the American consulate, Melbourne; publications of the Imp. Inst., London.

[2] Figures relate to the fiscal year ended June 30 of year stated.

[3] Exports.

[4] Content of copper reported as follows: 1925, 98.8 per cent; 1926, 98.3 per cent.

[5] Content of copper reported as follows: 1924, 25 per cent; 1925, 22.5 per cent; 1926, 21.2 per cent; 1927, not stated.

[6] Data not available.

PARAGUAY [45]

Although many useful minerals occur in Paraguay, the mineral industry of the country is little developed. Iron is widely distributed and abundant, and many deposits of copper and manganese are reported in the Cordilleritas. Other useful mineral resources found embrace glass sand, graphite, gypsum, kaolin, marble and other building stones, sulphur, and talc. Sulphur has been produced in small quantities for more than a century, and iron is smelted on a small scale for local needs. No figures of production are available.

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[44] Information supplied by the American consulate, Panama.

[45] Romero, G., Nuestra Riqueza Minera: Cartilla informativa No. 18, Asunción, 1930, 70 pp.

PERSIA

The petroleum reserves of Persia are generally conceded to be very large, and production of this mineral is growing steadily in importance. The output for the period under review is reported as follows:[46] 1924, 4,312,986 tons; 1925, 4,651,913 tons; 1926, 4,758,599 tons; 1927, 5,325,880 tons; 1928, 5,832,261 tons; 1929, 5,549,000 tons.

Many other minerals are known to occur in Persia, and a number of the deposits have been worked for years, but no statistics of output are available. Some of the more important deposits are as follows:[47]

Abrasives—emery of good quality is found in considerable quantities near Niriz in eastern Farsistan. Alum—three small mines are worked near Yezd, and the mineral occurs in many other places. Arsenic—found widely distributed, in the form both of realgar and orpiment. At one time, the deposits near Kazvin furnished arsenic for export. Asbestos—small quantities are produced in the Kerman district, but the fiber is said to be too short and brittle to be of much commercial value. Borax—obtained from deposits on the northern border of the Sierjan Desert and marketed in Kerman, Yezd, and Schiraz; also occurs on Kuh-i-Mish Mountain and on Lake Urmia. Clay—deposits of fire clay, kaolin, pottery, and brick clays are large and widely distributed. Coal—reported exposed at many places in the Elbruz Mountains, and the deposits there are worked on a small scale by the natives; found also in the Kerman and other districts. Copper—said to occur in every Province of Persia; the potential supplies are believed to be large, but development at present is limited to a few small mines worked by natives. Remains of ancient workings are found. Gems—in ancient times large quantities of lapis lazuli were obtained around Mount Demawend near Teheran, but the location of the mine has been lost and very little lapis is now produced; four important turquoise mines are known near Nishapur in Khorassan, but they have not been worked in recent years. Graphite—small deposits said to be under development near Hamadan. Gypsum—large quantities produced throughout Persia and used as building material. Iron—the deposits of ore near Semnan, 50 miles east of Teheran, are said to be rich and extensive; many other deposits are reported, but their commercial possibilities are not known. Iron oxide is produced in south Persia and shipped to Europe. Lead—small mines are exploited in casual fashion in Khorassan, and unexplored or abandoned deposits are reported in many places in the northern provinces. Manganese—unexplored deposits are reported in Kerman. Marble—the marbles of Persia are very beautiful and occur in abundance. Nickel—an occurrence is reported near Lingeh on the south coast. Potassium nitrates—reported as occurring in large quantities; small mines are worked in the Hamadan district. Salt—production of rock salt is widespread and constitutes an important source of Government revenue; salt is also produced by evaporation of the waters of Lake Urmia and other salt lakes. Sodium sulphate—one mine reported near Semnan. Sulphur—the sulphur deposits of Persia are of two types, solfataric and sedimentary. Large quantities of the first type are found at the crater of Demawend; the second is widely distributed throughout the country. Both types have furnished sulphur for domestic trade.

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[46] Data supplied by the Anglo-Persian Oil Co. (Ltd.), through the American consulate, London.

[47] Information furnished by the American consulate, Teheran, 1929 and 1931; Toll, I. M., Mineral Deposits in Persia, 19 pp. (Unpublished manuscript, prepared in 1921.)

PERU

Mineral production of Peru, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony: Mine production [2] tons	------------	17	99	111	140	108
Arsenic, white do	------------	[3] 119	------------	------------	------------	------------
Asphaltite do	2,708	1,068	690	892	981	950
Borates do	519	526	532	268	267	------------
Cement do	------------	11,278	29,295	49,349	48,475	49,137
Coal:						
Anthracite do	151,735	100,681	170,070	158,601	177,513	39,513
Bituminous do						180,141
Coke, metallurgical do	20,000	18,010	25,960	13,812	19,331	35,899
Copper:						
Mine production [2] do	33,938	36,844	42,511	55,368	[4] 56,457	[4] 56,115
Smelter production kilograms	[5]33,937,956	[5]36,863,979	[5]42,940,000	46,377,102	52,292,000	53,961,605
Gold, fine grams	3,700,000	3,420,378	2,860,000	2,878,140	2,192,980	3,799,100
Gypsum tons	12,272	14,644	16,004	13,225	20,148	15,299
Lead:						
Mine production [2] do	843	16,574	20,541	[4] 14,255	[4] 31,650	[4] 28,266
Smelter production [6] kilograms	149,000	115,000	122,000	171,000	14,466,000	19,448,000
Lime tons	5,325	5,330	3,544	3,600	3,500	3,494
Petroleum, crude do	1,045,547	1,219,955	1,394,951	1,340,599	1,591,552	1,776,758
Salt do	28,979	28,371	30,114	29,997	32,669	30,000
Silver, fine kilograms	582,180	645,316	700,561	571,757	678,622	668,590
Stone:						
Limestone tons	61,856	74,000	93,399	58,643	76,142	94,516
Marble do	190	------------	------------	------------	------------	------------
Quartzite and other dressed stone tons	17,033	21,861	15,268	12,490	12,092	10,092
Tungsten concentrates kilograms	------------	5,439	------------	------------	------------	------------
Vanadium [2] do	613,954	245,829	857,020	717,099	73,164	902,457
Zinc: Mine production [2] tons	145	14,418	22,975	21,589	28,587	23,686

[1] Source of data: Peru, Dirección de Minas y Petróleo del Ministerio de Fomento—Movimiento Econ. de la Ind. Min. del Peru, Lima (annual), except as otherwise noted.

[2] Content of ores, concentrates, etc.

[3] White arsenic exported by the Anglo-French Ticapampa Silver Mining Co. (Ltd.).

[4] Output of the more important districts only; that is, those reporting production of not less than 100 tons of fine metal.

[5] Includes estimated copper content of ores, concentrates, etc., exported.

[6] Data furnished by C. H. Cunningham, American commercial attaché, Lima, Apr. 22, 1930.

PHILIPPINE ISLANDS

Mineral production of Philippine Islands, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Cement tons	45,486	48,393	60,347	65,909	65,063	76,680
Coal do	47,938	48,681	28,577	23,410	27,857	17,321
Gold, fine [2] grams	2,485,000	2,928,000	2,838,000	2,467,000	3,317,000	4,996,000
Gypsum, crude tons	2,840	2,000	387	------------	------------	------------
Iron, pig do	273	398	306	200	209	166
Lime do	13,759	16,721	18,527	11,848	15,339	20,394
Phosphate rock do	6,528	7,528	7,512	705	1,550	1,492
Platinum, crude grams	------------	137	248	95	------------	------------
Salt [3] tons	28,919	30,683	24,075	66,669	71,475	46,876
Sand, gravel, and crushed stone cubic meters	598,145	567,545	685,510	1,398,081	4,863,159	2,414,420
Silica tons	------------	------------	------------	------------	34	------------
Silver, fine [2] kilograms	1,341	2,132	1,369	882	1,132	3,156
Stone, building and ornamental cubic meters	16,894	17,062	55,321	35,580	113,093	23,030
Sulphur kilograms	------------	------------	20	------------	100	18,340

[1] Source of data: Information supplied by Div. Geol. and Mines, Bur. Science, Manila, except as otherwise noted.

[2] Figures as published by the Director, U. S. Mint.

[3] Produced largely by solar evaporation.

POLAND

Mineral production of Poland, 1924–1929[1]

Mineral	1924	1925	1926	1927	1928	1929
Briquets, fuel........tons	444,231	375,100	239,160	252,779	264.362	354,783
Cadmium........kilograms	18,703	3,555	5.250	6,150	4,213	3,584
Cement, Portland........tons	408,800	496,300	618,700	803,700	1,102,000	1,008,300
Coal:						
Bituminous........do	32,280,482	29,081,327	35.747.348	38,084,086	40,616,384	46.236,037
Lignite........do	88,688	65,675	76,026	78,464	73,560	74,321
Coke........do	949,758	963,964	1,113,380	1,402,008	1,667,906	1,858,052
Coke by-products:						
Ammonium sulphate........do	12,708	14,544	17,004	22,558	36,722	36.145
Benzol........do	10,752	12,396	14,436	18,125	21,141	23,070
Tar........do	40,272	44,712	51,948	66,472	80,438	87,884
Gypsum........do	(2)	(2)	17,676	(2)	(2)	(2)
Iron:						
Ore........do	293,021	214,062	316,847	546,370	736,755	659,568
Pig iron........do	334,341	314,564	327,471	618,209	683,951	705,532
Lead:						
Concentrates........do	17,126	20,678	17,546	18,085	17,366	16,548
Metal (smelter product)[3]........kilograms	20,331,000	28,637,000	27,924,000	29,574,000	37,078,000	35.789,000
Lime........tons	461,443	579,225	620,889	663,814	856,219	(2)
Litharge........do	854	825	596	1,429	2,146	2,065
Natural gas........cubic meters	437,943,000	535,010,000	481,367,000	454,139,000	459,486,000	467,285,000
Ozokerite........kilograms	724,622	737,521	723,049	735,732	766.790	835,190
Petroleum, crude........tons	770,792	811,928	796,082	722,596	742,896	674,689
Phosphate rock........do	1,875	------------	380	17,614	20,311	39,294
Potash:						
Kainite........do	23,515	62,823	79,166	127,722	146,692	137,858
Sylvinite........do	57,875	115,980	128,523	148,340	194,964	220,770
Total equivalent in K_2O........do	17,981	37,597	38,942	43,825	55,611	63,735
Pyrite, iron........do	7,843	11,217	18,850	24,596	10,668	9,410
Salt........do	371,182	429,988	457,503	498,435	548,377	569,488
Silver........kilograms	10,603	15,160	8,411	5,907	6,937	11,717
Zinc:						
Concentrates........tons	291,586	375,313	405,007	337,874	309,190	373,592
Crude zinc........kilograms	93,086,000	114,339,000	123,741,000	150,299,000	161,766,000	169,029,000
Zinc dust........tons	4,463	4,563	7.167	9,340	9,195	8,323
Zinc oxide........do	533	4,070	6,453	11,992	13,870	8,730
Zinc sulphate........do	960	83	------------	------------	------------	------------

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[1] Source of data: Annuaire Statistique de la République Polonaise, Warsaw (annual); data furnished by the Ministry of Commerce and Industry, Warsaw, and the Legation of Poland, Washington, except as otherwise noted.

[2] Data not available.

[3] Includes some zincky lead.

PORTUGAL

Mineral production of Portugal, 1924–1929[1]

Mineral	1924	1925	1926	1927	1928	1929
Amblygonite........tons	(2)	91	42	96	155	8
Antimony concentrates[3]........do	36	37	----------	----------	----------	----------
Arsenic:						
Ore........do	279	76	7	47	(2)	9
White arsenic........do	874	1,092	354	(2)	134	105
Clay: Kaolin........do	181	2,623	2,747	3,848	4,215	3,880
Coal:						
Anthracite........do	124,801	123,450	200,329	177,322	198,847	178,513
Bituminous........do			1,403	1,232	2,501	18,388
Lignite........do	8,121	16,970	30,699	25,713	26,450	29,343
Copper:						
Ore........do	(2)	(2)	[4] 957	(2)	(2)	2,340
Cement copper[5]........do	1,131	1,462	1,807	1,252	1,319	1,057
Iron ore........do	8,573	2,000	1,640	7,600	14,000	11,126

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[1] Source of data: Portugal, Direcção Geral de Minas e Serviços Geológicos, Bol. de Minas, Lisbon, 1927; data furnished by the Portuguese Government through the American consul general, Lisbon; publications, Imp. Inst., London.

[2] Data not available.

[3] Average antimony content reported as 50 per cent.

[4] Average copper content reported as 11 per cent.

[5] Copper content reported as follows: 1924 and 1925, 65 to 70 per cent; 1926, 60 to 76 per cent; 1927, 60 to 75 per cent; 1928, 71 to 78 per cent; 1929, 55 to 75 per cent.

Mineral production of Portugal, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Lead:						
Concentrates[6] ... tons	80	96	247	648	411	282
Metal (smelter product) ... kilograms	31, 000	60, 000	140, 000	60, 000	83, 600	94, 000
Lepidolite ... do	(2)	216, 600	186, 550	385, 000	341, 000	752, 500
Manganese ore ... tons	(7)	(7)	...	491	...	...
Peat ... do	(2)	100	130	(2)	132	130
Pyrite:						
Cupreous ... do	220, 283	206, 593	210, 487	301, 035	242, 122	320. 450
Iron ... do		10, 703				63, 900
Salt[8] ... do	90, 804	33, 744	49, 404	49, 552	46, 777	15, 317
Tin:						
Concentrates[9] ... do	187	1, 032	1, 285	1, 178	1, 102	733
Metal (smelter product) ... kilograms	5, 903	2. 489	1, 175	3. 000	746	...
Tin-tungsten ore ... do	860	(2)	(2)	(2)	(2)	(2)
Titanium ore (ilmenite) ... do	52, 500	2, 600	1, 030	703, 000	702, 800	56, 000
Tungsten concentrates (wolframite)[10] ... tons	280, 940	191, 178	410, 932	161, 000	139, 348	336, 087
Uranium ore[11] ... do	367, 060	158, 443	...	200	143, 740	(2)
Zinc ore[12] ... tons	40	65	[13] 540	382	...	...

[2] Data not available.

[6] Lead content reported as follows: 1924, 46 to 60 per cent; 1925, 71 to 60 per cent; 1926, 55 to 70 per cent; 1927 and 1928, 60 to 70 per cent; 1929, 43 to 60 per cent.

[7] Production data not available. Exports of manganese ore reported as follows: 1924, 125 tons; 1925, 11 tons.

[8] Exports.

[9] Tin content reported as follows: 1924, 30 to 66 per cent; 1925, 50 to 60 per cent; 1926, 50 to 65 per cent; 1927, 50 to 67 per cent; 1928, 60 to 65 per cent.

[10] Content of WO_3 reported as follows: 1924, 65 per cent; 1925, 60 to 65 per cent; 1926, 40 to 65 per cent; 1927, 1928, and 1929, 65 per cent.

[11] Content of U_3O_8 reported as follows: 1924, 1 per cent; 1925, 0.5 to 1 per cent; 1927, 0.5 per cent; 1928, data not available.

[12] Zinc content reported as follows: 1924, not stated; 1925, 51 per cent; 1926, zinc ore, 44 to 48 per cent, zinc-lead ore, 35 per cent; 1927, 40 per cent.

[13] Includes 304 tons of zinc-lead ore.

PORTUGUESE EAST AFRICA (MOZAMBIQUE)

The known mineral deposits of Portuguese East Africa comprise asbestos, coal, copper, diamonds, gold, iron, petroleum, silver, and tin. Chrysotile asbestos, copper, placer gold and silver, and tin are found in the Masaquece district. The Tete coal field, which began producing in 1925, is large and important; other coal deposits have been reported but to date have remained undeveloped. Alluvial diamonds are found near Caia on the Langue River. Iron ore occurs in Tete, but the deposits have not been developed. Drilling for petroleum at Inyaminga in the Inhambane district has been in progress for several years, but no commercial production has been reported to date.[48]

The mineral production from 1924 to 1929, inclusive, is reported as follows:

Mineral production of Portuguese East Africa, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Coal ... tons	...	18, 086	10, 868	15, 834	6, 455	(b)
Copper ore ... kilograms	2, 420	...	...	...	...	...
Gold ... grams	356, 695	382, 324	284, 472	296, 136	131, 848	13, 965
Silver ... kilograms	33	39	...	21	10	2
Tin ore ... tons	...	...	2	11	16	5

[a] Source of data: Information supplied by the American consulate, Lourenço Marques; publications of the Imp. Inst., London.

[b] Data not available.

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[48] Information supplied by the American consulate, Lourenço Marques; Pyke, J., Economic Conditions in Portuguese East Africa: Great Britain, Department of Overseas Trade, London, 1930, 66 pp.

PORTUGUESE EAST INDIES (TIMOR) [49]

Gold, manganese ore, and petroleum have been reported in Portuguese Timor; but, so far as known, only the manganese deposits have been worked commercially to date.

Placer gold is won in small quantities by the natives from the bed of the Laclo River. Indications of oil have been found at several places; and exploratory drilling has been done, but no commercial output has been reported. Manganese ore to the amount of 3,300 tons was exported in 1929. No data are available as to operations in previous years.

PORTUGUESE INDIA (GÔA)

So far as known, the mineral industry of Portuguese India is limited to the production of sea salt and manganese. Deposits of gold and iron have been reported, but no data are available as to their commercial importance.

The annual output of salt is estimated to be about 12,000 tons.[50] Exports of manganese ore of domestic origin from 1926 to 1929, inclusive, are reported as follows: [51] 1926, 3,089 tons; 1927, 2,414 tons; 1928, 4,164 tons; 1929, 4,948 tons.

PORTUGUESE WEST AFRICA

Angola.—Asphalt, coal, copper, diamonds, gold, iron, silver-lead, manganese, mica, petroleum, sulphur, salt, and tin are reported to occur in Angola,[52] but production on a commercial scale has been reported only for diamonds and salt.

The copper mines at Bembe are estimated to contain 300,000 tons of copper, but profitable operation of the mines is contingent on the development of transportation. Alluvial gold deposits in the Mossamedes district have been worked by the natives on a small scale for a number of years. Promising oil indications are found in the coastal plain; and test drilling has been done, but to date no commercial production has been reported. Rock salt is mined in several districts by the natives for local use, and salt is produced on the coast by the evaporation of sea water. The total annual salt production is estimated at 10,000 tons.[53] The production of diamonds began in June, 1916, and has increased steadily. Output for the years under review was as follows: [54] 1924, 118,016 carats; 1925, 123,282 carats; 1926, 154,369 carats; 1927, 200,809 carats; 1928, 237,511 carats; 1929, 311,903 carats.

Guinea.—Iron ore has been reported as crudely mined and smelted by the natives,[55] but no other mineral industry is known.

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[49] Information supplied by the American consulates at Lisbon and at Batavia, Java.

[50] Imperial Institute, Statistical Summary, London (annual).

[51] Figures for 1926 and 1927 as reported in Records of the Geological Survey of India, Calcutta (annual); those for 1928 and 1929 supplied by the American consulate, Bombay, India.

[52] Bebiano, J. B., Missões economicas para o estudo da geologia e flora de Angola: Soc. de Geogr. de Lisboa, Bol. Series 46^a, Nos. 3–4, Lisbon, 1928, pp. 77–96.

[53] Information supplied by the American consulate, Loanda, Angola.

[54] Imperial Institute, Statistical Summary, London (annual).

[55] Handbook of West Africa, London, 1920.

RHODESIA

Mineral production of Northern Rhodesia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Copper (smelter output)......kilograms	99, 790	75, 188	719, 363	3, 342, 805	6, 025, 613	5, 553, 465
Gold, fine......grams	38, 724	38, 879	24, 230	10, 886	18, 724	21, 741
Iron ore......tons	......	......	......	3, 474	4, 538	3, 613
Lead (smelter output)......kilograms	5, 999, 181	3, 405, 800	3, 896, 552	5, 951, 005	4, 751, 050	1, 661, 242
Mica......do	......	589	3, 607	7, 620	3, 597	2, 685
Manganese ore......tons	......	......	......	705	1, 821	1, 879
Silver, fine......kilograms	7, 303	164	1, 367	571	3	70
Vanadium oxide......do	28, 123	......	174, 029	219, 467	(2)	(2)
Zinc:						
Ore......tons	......	6, 298	453	......	(3)	(3)
Metal (smelter output)....kilograms	......	240, 103	239, 656	......	[4]9,751,032	[4]12,315,542

[1] Source of data: Rhodesia Chamber of Mines, Annual Report, Bulawayo, except as otherwise noted.

[2] Production of vanadium oxide not reported. Vanadium content of ores produced reported as follows: 1928, 51,553 kilograms; 1929, 59,552 kilograms.

[3] Figures for output of ore not available. Zinc content of ores produced reported as follows: 1928, 13,387,475 kilograms; 1929, 22,586,792 kilograms.

[4] Figures as published by Imp. Inst., London, converted to kilograms.

Mineral production of Southern Rhodesia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Corundum..tons..	38	44	39	......	23	20
Antimony [2]......do....	......	19	30	......	50	......
Arsenic, white......do....	533	170	49	38	102	52
Asbestos......do....	23, 715	31, 161	30, 249	30, 097	36, 251	38, 677
Barite......do....	64	36	27	13	77	264
Chromite......do....	156, 692	123, 220	164, 376	197, 782	199, 060	265, 909
Coal......do....	591, 526	689, 201	874, 140	908, 744	1, 094, 843	1, 036, 816
Coke......do....	137, 078	138, 339	153, 069	146, 966	139, 719	100, 001
Copper (smelter output)......kilograms..	2, 564, 598	1, 713, 663	7, 257	......	110, 377	361, 965
Diamonds......carats..	596	189	106	126	122	232
Gold, fine......grams..	19, 524, 557	18, 086, 799	18, 457, 708	18, 084, 746	17, 919, 089	17, 443, 236
Iron ore......tons..	......	1, 063	1, 923	477	3, 112	3, 406
Lead [2]......do....	......	5	5	8	54	......
Lepidolite......kilograms..	......	......	......	19, 958	......	......
Mica......tons..	136	132	166	186	186	172
Silver, fine......kilograms..	5, 178	4, 750	3, 422	3, 522	3, 229	2, 713
Tantalum......do....	......	......	907	......	......	......
Tin [2]......tons..	9	17	15	24	7	13
Tungsten concentrates..do....	20	20	......	30	14	26
Zinc [2]......do....	......	......	......	......	165	......

[1] Source of data: Rhodesia Chamber of Mines, Annual Report, Bulawayo.

[2] Estimated content of ores and concentrates produced.

RUMANIA

Mineral production of Rumania, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Millstones ......cubic meters.	......	......	......	......	15	55
Amber......kilograms.	230	140	140	156	30	20
Aragonite......cubic meters	......	......	20	55	71	254
Asphalt, crude......tons.	19, 731	15, 709	24, 891	30, 712	8, 875	......
Bauxite......do	......	......	745	1, 706	653	926
Bismuth, metallic ......kilograms	......	63	......	......	......	......
Cement......tons	(2)	190, 241	(2)	(2)	(2)	(2)
Clay:						
Fire clay..cubic meters.	......	......	......	430	250	770
Kaolin......do	4, 258	4, 592	3, 298	3, 958	3, 593	3, 688
Other clay......do....	499, 978	599, 270	624, 008	675, 321	632, 324	465, 412

[1] Source of data: Rumania, Inst. de Statistica Gen. a Stat., Statistica Miniera, Bucharest (annual).

[2] Data not available.

Mineral production of Rumania, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Coal:						
Anthracite----------tons--	150	------------	------------	------------	------------	------------
Bituminous----------do----	297, 138	313, 572	322, 191	373, 457	397, 564	370, 947
Lignite-------------do----	2, 479, 083	2, 615, 278	2, 731, 362	2, 850, 011	2, 629, 676	2, 675, 080
Copper:						
Ore-----------------tons--	4, 365	8, 147	22, 640	4, 990	3, 327	12, 503
Metal (smelter output) ------------kilograms--	89, 635	132, 661	189, 184	215, 455	103, 671	143, 470
Feldspar [3]-------------tons--	------------	423	1, 700	1, 943	2, 835	2, 479
Gold, fine------------grams--	1, 310, 613	1, 245, 238	1, 730, 997	2, 005, 588	1, 808, 918	2, 212, 836
Gold-silver-lead-antimony-copper ores-----------tons--	199, 713	176, 197	201, 877	223, 457	272, 572	289, 992
Gravel--------cubic meters--	88, 087	185, 295	109, 920	176, 384	149, 868	138, 270
Gypsum, crude [3]-------tons--	20, 782	53, 845	44, 316	77, 724	47, 785	76, 625
Iron:						
Ore-----------------do----	102, 537	107, 384	102, 799	97, 138	83, 869	90, 014
Pig iron------------do----	46, 081	64, 273	62, 979	63, 498	70, 123	72, 346
Lead:						
Ore-----------------do----	32	------------	------------	------------	------------	16
Metal (smelter output)[4] ------------kilograms--	433, 118	489, 137	655, 384	828, 197	537, 370	565, 222
Manganese ore---------tons--	6, 482	5, 368	8, 353	10, 369	31, 267	35, 038
Mercury:						
Ore-----------------do----	1, 583	4, 273	2, 006	2, 024	------------	------------
Metallic mercury ------------kilograms--	254	3, 257	2, 026	3, 560	------------	------------
Mica------------------do----	------------	------------	------------	286	------------	------------
Mineral paint ores -------------cubic meters--	------------	650	497	160	469	970
Natural gas------------do----	4, 616, 546, 300	[5] 369, 819, 723	[5] 376, 754, 066	[5] 439, 037, 943	[5] 613, 023, 563	[5] 806, 598, 904
Ozokerite--------kilograms--	------------	2, 858	------------	------------	------------	------------
Petroleum, crude------tons--	1, 860, 471	2, 316, 979	3, 244, 415	3, 669, 354	4, 282, 377	4, 836, 974
Phosphate rock--------do----	------------	------------	------------	------------	------------	[3] 1, 626
Pyrite, iron-----------do----	32, 657	26, 983	42, 039	25, 514	23, 715	23, 851
Salt:						
Rock salt-----------do----	302, 761	330, 356	344, 062	328, 028	340, 212	318, 802
Other salt----------do----	1, 337	448	------------	3	2, 567	2, 698
Sand----------cubic meters--	179, 467	185, 295	219, 395	283, 725	275, 828	220, 242
Silica (quartz)---------do----	------------	------------	139	17, 785	1, 541	23, 112
Silver, fine-------kilograms--	2, 246	2, 382	2, 914	4, 376	2, 279	2, 822
Stone:						
Basalt-----cubic meters--	(2)	38, 240	57, 655	75, 935	91, 694	113, 474
Dolomite-----------do----	1, 510	1, 272	644	------------	24, 811	20, 457
Granite------------do----	(2)	181, 836	175, 966	173, 628	135, 637	165, 524
Limestone----------do----	214, 560	583, 738	688, 604	692, 603	572, 662	541, 763
Marble-------------do----	862	1, 728	1, 430	1, 550	2, 307	1, 769
Marl---------------do----	15, 079	14, 867	16, 149	34, 141	134, 741	154, 021
Sandstone----------do----	29, 047	29, 198	32, 496	27, 953	18, 786	15, 083
Other stone--------do----	313, 309	94, 443	54, 195	128, 599	182, 802	113, 764
Talc and soapstone [3]---tons--	51	122	488	1, 138	2, 164	1, 077

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[3] Reported in cubic meters, which have been converted to tons on the basis of 1 cubic meter=2.0321 tons.

[4] Includes antimonial lead.

[5] Gas consumed.

RUSSIA

Mineral production of Russia, 1924–1928 [1]

Mineral	1924	1925	1926	1927	1928
Abrasives:					
Corundum and emery--------tons--	1, 460	4, 786	7, 296	6, 754	9, 605
Diatomite-------------------do----	------------	2, 344	8, 055	5, 187	12, 220
Millstones and grindstones [2]--do----	(3)	2, 892	6, 413	7, 393	5, 164
Pumice----------------------do----	------------	500	754	446	3, 037
Alumstone--------------------do----	1, 625	1, 042	647	1, 364	1, 812
Alunite clay------------------do----	500	1, 125	3, 305	3, 065	(3)
Asbestos---------------------do----	8, 456	12, 330	18, 334	21, 156	26, 492
Asphalt and bituminous sandstone:					
Asphalt rock-----------------do----	(3)	9, 043	27, 839	46, 040	21, 460
Bituminous sandstone--------do----	(3)	2, 245	2, 767	2, 338	27, 160

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[1] Source of data: Russia, Geological Committee. Annual Report on the Mineral Resources of the U. S. S. R.; Statistical Summary on the Mineral Industry of the U. S. S. R. (annual) except as otherwise stated. The data relate to the fiscal year ended Sept. 30, except as otherwise noted. Official figures for 1929 not available.

[2] In addition to the tonnage shown, the following number of stones was reported, weight not stated: 1925, 7,683 stones; 1926, 11,232 stones; 1927, 5,304 stones; 1928, 1,697 stones.

[3] Data not available.

Mineral production of Russia, 1924–1928—Continued

Mineral	1924	1925	1926	1927	1928
Barite ... tons	737	4, 684	14, 389	8, 496	3, 937
Bismuth concentrates ... kilograms	....	25	7	108	59
Borates:					
Borates, crude ... do	(3)	1, 000	1, 600	3, 200	(3)
Borax ... do	(3)	640, 000	1, 175, 800	1, 024, 400	(3)
Boric acid ... do	(3)	40, 800	87, 000	782, 300	(3)
Bromine:					
Bromine ... do	....	....	3, 300	30, 600	82, 100
Ferrobromine ... do	....	....	....	14, 800	123, 700
Cement ... tons	368, 580	729, 555	1, 334, 721	1, 647, 000	1, 934, 672
Chalk ... do	158, 233	609, 234	1, 070, 485	1, 148, 385	1, 384, 552
Chromite ... do	11, 894	30, 111	30, 362	19, 294	29, 536
Clay:					
Fire clay ... do	197, 488	400, 738	754, 013	846, 745	975, 114
Kaolin ... do	24, 883	72, 488	138, 932	51, 656	163, 281
Other clay ... do	(3)	(3)	(3)	(3)	2, 582, 228
Coal: [4]					
Anthracite ... do	3, 516, 692	3, 345, 003	5, 364, 467	7, 081, 039	8, 195, 133
Bituminous ... do	11, 129, 264	11, 638, 563	18, 119, 273	22, 817, 075	24, 675, 366
Lignite ... do	1, 664, 537	1, 516, 900	2, 299, 693	2, 632, 458	2, 882, 328
Coke ... do	[5] 723, 800	[5] 1, 350, 300	2, 755, 841	3, 327, 904	5, 103, 741
Copper:					
Ore ... do	100, 363	170, 083	379, 885	473, 910	631, 888
Blister [6] ... kilograms	264, 000	8, 179, 000	8, 948, 000	10, 852, 000	18, 996, 000
Electrolytic [7] ... do	5, 559, 000	12, 475, 000	17, 390, 000	19, 094, 000	(3)
Refined [6] ... do	2, 002, 000	863, 000	1, 686, 000	2, 745, 000	(3)
Feldspar ... tons	5, 049	10, 330	20, 960	19, 324	20, 308
Fluorspar ... do	215	1, 211	3, 765	840	5, 551
Glauberite ... do	(3)	2, 221	7, 960	12, 920	15, 089
Glauber's salt ... do	(3)	18, 898	64, 249	99, 724	108, 230
Gold ... grams	16, 586, 000	19, 270, 026	24, 930, 639	22, 553, 649	[8] 37, 325, 000
Graphite ... tons	169	2, 485	6, 425	6, 857	2, 222
Gravel ... do	(3)	58, 387	194, 318	119, 871	201, 964
Gypsum, crude ... do	53, 559	169, 023	308, 162	283, 002	411, 365
Iodine ... kilograms	....	....	....	....	272
Iron:					
Ore ... tons	944, 595	2, 224, 458	3, 430, 432	4, 813, 006	5, 924, 426
Pig iron ... do	669, 642	1, 308, 733	2, 217, 933	2, 953, 514	3, 281, 977
Lead:					
Ore (silver-lead) ... do	20	793	2, 072	3, 430	1, 005
Metal (smelter output) ... kilograms	685, 000	1, 021, 000	1, 342, 000	1, 217, 000	2, 592, 000
Lithographic stones, cut ... number	....	....	....	305	568
Magnesite, crude [9] ... tons	33, 214	75, 840	103, 017	106, 583	119, 985
Manganese ore ... do	426, 825	676, 502	1, 028, 607	843, 850	673, 398
Mercury:					
Ore ... do	18, 903	1, 860	22, 060	24, 799	42, 870
Metallic ... kilograms	65, 300	9, 890	126, 780	74, 040	101, 700
Mica:					
Run-of-mine ... do	(3)	192, 910	485, 530	1, 519, 790	1, 492, 740
Sheets ... do	(3)	23, 370	49, 860	85, 940	110, 130
Molybdenum:					
Ore ... tons	....	....	484	191	79
Concentrates [10] ... kilograms	....	....	3, 920	3, 770	1, 700
Natural gas ... cubic meters	(3)	122, 652, 000	216, 882, 000	244, 980, 000	252, 700, 000
Oil shale ... tons	11, 684	1, 130	1, 871	9, 434	562
Ozokerite ... do	92	392	955	843	710
Petroleum, crude [4] ... do	6, 025, 517	7, 081, 333	8, 341, 478	10, 338, 327	11, 73 , 977
Phosphate rock ... do	23, 380	39, 824	72, 516	56, 460	121, 711
Platinum [11] ... grams	2, 079, 000	2, 948, 000	2, 883, 000	(3)	(3)
Potash, carbonate [12] ... tons	2, 803	3, 146	3, 265	3, 784	6, 057
Pyrite ... do	27, 184	54, 996	109, 394	225, 318	152, 041
Salt:					
Rock salt ... do	275, 215	556, 978	569, 019	743, 667	936, 629
Other salt ... do	1, 053, 887	1, 047, 816	1, 283, 584	1, 682, 299	1, 869, 112
Sand:					
Glass sand ... do	(3)	47, 788	101, 130	86, 336	5, 555, 192
Other sand ... do	(3)	454, 138	2, 131, 194	2, 635, 704	
Silica:					
Flint ... do	....	....	656	1, 300	1, 949
Quartz ... do	(3)	86, 196	153, 309	95, 902	97, 503
Silver ... kilograms	3, 500	5, 739	13, 028	18, 370	21, 390

[3] Data not available.

[4] Includes output of Sakhalin.

[5] Figures as published in Stahl u. Eisen, April 29, 1926.

[6] Exclusive of secondary copper.

[7] Includes secondary copper.

[8] Figures as published by the Director, U. S. Mint.

[9] In addition, the following quantities of magnesite sand were reported as produced: 1927, 77,211 tons; 1928, 8,799 tons.

[10] Content of MoS_2 reported as follows: 1926, 88 per cent; 1927, 85 to 87 per cent; 1928, not stated.

[11] Calendar year.

[12] From sunflower ash.

Mineral production of Russia, 1924–1928—Continued

Mineral	1924	1925	1926	1927	1928
Soda:					
Natural soda……tons	(3)	2,623	9,798	16,968	10,051
Manufactured soda……do	(3)	505	2,756	3,302	3,090
Stone:					
Cobblestones……do	(3)	140,484	283,234	287,435	369,610
Dolomite……do	(3)	158,811	179,753	228,857	274,310
Granite……do	(3)	251,181	626,123	894,929	1,055,519
Limestone—					
Building stone [13]……do	(3)	63,722	177,079	122,053	197,018
Rubble, ashlars, etc……do	(3)	287,367	961,243	681,790	384,322
Other limestone……do	(3)	1,498,048	3,131,566	3,263,533	4,478,501
Marble……do	(3)	[14] 176	[14] 2,325	4,099	11,780
Marl, for cement……do	247,045	581,237	1,170,990	1,242,101	1,323,878
Quartzite……do	(3)	158,386	193,046	115,994	182,829
Sandstone……do	(3)	277,302	653,646	2,091,617	762,284
Other stone……do	(3)	9,112	20,878	67,591	202,776
Talc and soapstone……do	(3)	569	2,995	2,118	5,568
Titanium ore (ilmenite)……do	------	------	41	------	5
Tungsten concentrates:					
Scheelite……kilograms	(3)	[15] 7,200	18,880	9,460	57,250
Wolframite……do	(3)	1,500	19,170	28,950	
Uranium ore and concentrates……tons	------	616	709	[16] 1,081	(3)
Zinc:					
Ore……do	2,676	3,430	913	1,697	180
Metal (smelter output) [17]……kilograms	517,000	1,492,000	1,888,000	2,266,000	2,246,000
Zinc-lead ore……tons	7,400	23,436	34,286	93,050	101,572
Zircon……kilograms	------	------	------	------	133

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[3] Data not available.

[13] In addition to the tonnage shown, the following quantities of stones were reported, weight not stated: 1925, 3,899,845 blocks; 1926, 5,802,525 blocks; 1927, 3,664,434 blocks; 1928, 7,642,158 blocks.

[14] In addition to the tonnage shown, the following quantities were reported in square meters, weight not stated: 1925, 138; 1926, 240.

[15] Figures as reported by Dengin, G. P., Tungsten: Min. Res. U. S. S. R., pt. 12, Leningrad, 1927.

[16] Content of U_3O_8 reported as 1.5 to 3 per cent. Similar data not available for preceding years.

[17] Produced at the Alagir plant, in the Caucasus.

Mineral production of Russia in Europe, 1924–1928

Mineral	1924	1925	1926	1927	1928
Abrasives:					
Corundum and emery……tons	1,460	4,786	7,296	4,918	6,123
Diatomite……do	------	2,344	8,055	5,187	12,220
Millstones and grindstones [1]……do	(2)	2,892	6,043	6,580	2,452
Pumice……do	------	500	754	446	3,037
Alumstone……do	1,625	1,042	647	1,364	1,131
Alumite clay……do	500	1,125	3,305	3,065	1,812
Asbestos……do	8,456	12,330	18,309	21,058	26,410
Asphalt and bituminous sandstone:					
Asphalt rock……do	(2)	9,043	27,839	46,040	21,460
Bituminous sandstone……do	(2)	2,245	2,767	2,388	27,160
Barite……do	737	4,684	13,249	6,971	3,937
Borates:					
Borates, crude……kilograms	(2)	1,000	1,600	3,200	(2)
Borax……do	(2)	640,100	1,175,800	1,024,400	(2)
Boric acid……do	(2)	40,800	87,000	782,300	(2)
Bromine:					
Bromine……do	------	------	3,300	30,600	82,100
Ferrobromine……do	------	------	------	14,800	123,700
Cement……tons	358,868	716,685	1,300,409	1,594,237	1,866,298
Chalk……do	158,233	608,577	1,068,863	1,148,381	1,384,552
Chromite……do	11,894	27,195	30,362	19,294	29,536
Clay:					
Fire clay……do	192,530	396,019	749,011	834,425	956,987
Kaolin……do	24,883	72,295	137,986	51,192	161,033
Other clay……do	(2)	(2)	(2)	(2)	2,530,282
Coal:					
Anthracite……do	3,516,692	3,345,003	5,364,467	7,081,039	8,195,133
Bituminous……do	9,332,615	10,009,008	15,250,250	18,863,302	20,632,686
Lignite……do	1,059,754	983,020	1,605,327	1,763,196	1,978,570
Coke……do	(2)	(2)	2,615,256	3,154,238	4,863,918

[1] In addition to the tonnage shown, the following number of stones was reported, weight not stated: 1925, 7,582 stones; 1926, 11,180 stones; 1927, 2,459 stones; 1928, 1,682 stones.

[2] Data not available.

Mineral production of Russia in Europe, 1924–1928—Continued

Mineral	1924	1925	1926	1927	1928
Copper:					
Ore……tons..	100, 363	170, 083	379, 885	472, 563	625, 726
Blister [3]……kilograms..	264, 000	8, 179, 000	8, 948, 000	10, 852, 000	18, 996, 000
Electrolytic [4]……do….	5, 559, 000	12, 475, 000	17, 390, 000	19, 094, 000	(2)
Refined [4]……do….	2, 002, 000	863, 000	1, 686, 000	2, 745, 000	(2)
Feldspar……tons..	5, 049	9, 650	19, 106	17, 205	19, 545
Fluorspar……do….	35	------	------	------	------
Glauberite……do….	------	------	------	49	29
Glauber's salt……do….	(2)	907	16, 829	5, 237	1, 963
Gold……grams..	3, 154, 000	3, 388, 004	2, 611, 012	2, 119, 948	(2)
Graphite……tons..	71	1, 685	4, 265	1, 635	600
Gravel……tons..	(2)	58, 387	194, 318	119, 871	197, 763
Gypsum, crude……do….	53, 559	165, 676	303, 690	264, 535	404, 856
Iodine……kilograms..	------	------	------	------	272
Iron:					
Ore……tons..	932, 969	2, 201, 706	3, 415, 278	4, 791, 530	5, 911, 456
Pig iron……do….	662, 646	1, 301, 769	2, 207, 984	2, 943, 422	3, 271, 585
Lead:					
Ore (silver-lead)……do….	------	49	465	22	------
Metal (smelter output)..kilograms..	231, 000	645, 000	848, 000	943, 000	939, 000
Lithographic stones, cut……number..	------	------	------	305	568
Magnesite [5]……tons..	33, 214	75, 840	103, 017	106, 583	119, 985
Manganese ore……do….	426, 825	676, 502	1, 028, 607	843, 850	673, 398
Mercury:					
Ore……do….	18, 903	1, 860	22, 060	24, 799	42, 870
Metallic mercury……kilograms..	65, 300	9, 890	126, 780	74, 040	101, 700
Mica:					
Run-of-mine……do….	(2)	18, 410	64, 670	15, 000	265, 440
Sheets……do….	------	------	90	------	6, 060
Natural gas……cubic meters..	(2)	122, 652, 000	216, 377, 000	243, 447, 000	251, 112, 000
Oil shale……tons..	11, 684	1, 130	1, 871	9, 434	562
Petroleum, crude……do….	5, 871, 063	6, 846, 938	8, 073, 540	9, 993, 896	11, 344, 637
Phosphate rock……do….	23, 380	39, 824	72, 516	56, 460	121, 711
Platinum [6]……grams..	2, 079, 000	2, 948, 000	2, 883, 000	(2)	(2)
Potash, carbonate [7]……tons..	2, 803	3, 146	3, 265	3, 784	6, 057
Pyrite……do….	27, 184	54, 996	109, 394	225, 318	152, 041
Salt:					
Rock salt……do….	275, 215	556, 978	569, 019	740, 188	933, 376
Other salt……do….	959, 958	820, 746	1, 116, 698	1, 475, 948	1, 614, 730
Sand:					
Glass sand……do….	(2)	46, 446	98, 030	83, 976	5, 528, 728
Other sand……do….	(2)	454, 138	1, 980, 984	2, 598, 546	
Silica:					
Flint……do….	------	------	656	1, 300	1, 949
Quartz……do….	(2)	85, 500	151, 784	93, 537	95, 843
Silver……kilograms..	2, 994	5, 097	13, 028	18, 345	21, 323
Stone:					
Cobblestones……tons..	(2)	140, 484	283, 234	287, 435	369, 610
Dolomite……do….	(2)	158, 811	179, 753	228, 857	274, 310
Granite……do….	(2)	213, 080	570, 034	728, 417	880, 094
Limestone—					
Building stone [8]……do….	(2)	63, 722	158, 963	122, 053	197, 018
Rubble, ashlars, etc……do….	(2)	287, 367	655, 004	673, 896	379, 668
Other limestone……do….	(2)	1, 472, 482	3, 072, 600	3, 146, 165	4, 337, 493
Marble……do….	(2)	[9] 176	[9] 1, 320	1, 783	10, 588
Marl, for cement……do….	247, 045	581, 237	1, 170, 990	1, 242, 101	1, 323, 878
Quartzite……do….	(2)	158, 357	192, 986	115, 994	182, 787
Sandstone……do….	(2)	276, 662	652, 119	2, 026, 185	517, 578
Other stone……do….	(2)	9, 112	17, 440	24, 483	182, 816
Talc and soapstone……do….	(2)	569	2, 995	2, 118	5, 568
Titanium ore (ilmenite)……do….	------	------	41	------	5
Tungsten concentrates (scheelite) [10]……kilograms..	(2)	7, 200	18, 880	8, 970	------
Zinc:					
Ore……tons..	2, 676	3, 430	913	1, 697	180
Metal (smelter product) [11]……kilograms..	517, 000	1, 492, 000	1, 888, 000	2, 266, 000	2, 246, 000
Zinc-lead ore……tons..	7, 400	23, 091	32, 082	33, 205	25, 439
Zircon……kilograms..	------	------	------	------	133

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[2] Data not available.

[3] Primary copper.

[4] Includes secondary copper.

[5] In addition, the following quantities of magnesite sand were reported produced: 1927, 77,211 tons; 1928, 8,792 tons.

[6] Calendar year.

[7] Produced from sunflower ash.

[8] See footnote 13 under preceding table.

[9] See footnote 14 under preceding table.

[10] Content of WO_3 reported as follows: 1925 not stated; 1926, 67–72 per cent; 1927, 70 per cent.

[11] Produced at the Alagir plant, in the Caucasus.

Mineral production of Russia in Asia, 1924–1928

Mineral	1924	1925	1926	1927	1928
Abrasives:					
Corundum and emery----tons--	------	------	------	1, 836	3, 482
Millstones and grindstones [1]----do----	(2)	------	370	813	2, 712
Asbestos----do----	------	------	25	98	82
Barite----do----	------	------	1, 140	1, 525	------
Bismuth concentrates----kilograms--	------	25	7	108	59
Cement----tons--	9, 712	12, 870	34, 312	52, 763	68, 374
Chalk----do----	------	657	1, 622	4	------
Chromite----do----	------	2, 916	------	------	------
Clay:					
Fire clay----do----	4, 958	4, 719	5, 002	12, 320	18, 127
Kaolin----do----	------	193	946	464	2, 248
Other clay----do----	(2)	(2)	(2)	(2)	51, 946
Coal:[3]					
Bituminous----do----	1, 796, 649	1, 629, 555	2, 869, 023	3, 953, 773	4, 042, 680
Lignite----do----	604, 783	533, 880	694, 366	869, 262	903, 758
Coke----do----	(2)	(2)	140, 585	173, 666	239, 823
Copper ore----do----	------	------	------	1, 347	6, 162
Feldspar----do----	------	680	1, 854	2, 119	763
Fluorspar----do----	180	1, 211	3, 765	840	5, 551
Glauberite----do----	(2)	2, 221	7, 960	12, 871	15, 060
Glauber's salt----do----	(2)	17, 991	47, 420	94, 487	106, 267
Gold----grams--	13, 432, 000	15, 882, 022	22, 319, 627	20, 433, 701	(2)
Graphite----tons--	98	800	2, 160	5, 222	1, 622
Gravel----do----	------	------	------	------	4, 201
Gypsum, crude----do----	------	3, 347	4, 472	18, 467	6, 509
Iron:					
Ore----do----	11, 626	22, 752	15, 154	21, 476	12, 970
Pig iron----do----	6, 996	6, 964	9, 949	10, 092	10, 392
Lead:					
Ore (silver-lead)----do----	20	744	1, 607	3, 408	1, 005
Metal (smelter output)----kilograms--	454, 000	376, 000	494, 000	274, 000	1, 653, 000
Mica:					
Run-of-mine----do----	(2)	174, 500	420, 860	1, 504, 790	1, 227, 300
Sheets----do----	(2)	23, 370	49, 770	85, 940	104, 070
Molybdenum:					
Ore----tons--	------	------	484	191	79
Concentrates [4]----kilograms--	------	------	3, 920	3, 770	1, 700
Natural gas----cubic meters--	------	------	505, 000	1, 533, 000	1, 588, 000
Ozokerite----tons--	92	392	955	843	710
Petroleum, crude [3]----do----	154, 454	234, 395	267, 938	344, 431	386, 340
Salt:					
Rock salt----do----	------	------	------	3, 479	3, 253
Other salt----do----	93, 929	227, 170	166, 886	206, 351	254, 382
Sand:					
Glass sand----do----	(2)	1, 342	3, 100	2, 360	26, 464
Other sand----do----	(2)	------	150, 210	37, 158	
Silica (quartz)----do----	(2)	696	1, 525	2, 365	1, 660
Silver----kilograms--	506	642	------	25	67
Soda:					
Natural soda----tons--	(2)	2, 623	9, 798	16, 968	10, 051
Manufactured soda----do----	(2)	505	2, 756	3, 302	3, 090
Stone:					
Granite----do----	(2)	38, 101	56, 089	166, 512	175, 425
Limestone—					
Building stone----do----	------	------	18, 116	------	------
Rubble, ashlars, etc----do----	------	------	306, 239	7, 894	4, 654
Other limestone----do----	(2)	25, 566	58, 966	117, 368	141, 008
Marble----do----	------	------	[5] 1, 005	[5] 2, 316	1, 192
Quartzite----do----	------	29	60	------	42
Sandstone----do----	------	640	1, 527	65, 432	244, 706
Other stone----do----	(2)	------	3, 438	43, 108	19, 960
Tungsten concentrates:					
Scheelite----kilograms--	------	------	------	490	[7] 57, 250
Wolframite [6]----do----	(2)	1, 500	19, 170	28, 950	
Uranium ore and concentrates----tons--	------	616	709	[8] 1, 081	(2)
Zinc-lead ore----do----	------	345	2, 204	59, 845	16, 133

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[1] In addition to the tonnage shown, the following number of stones was reported, weight not stated: 1925, 101 stones; 1926, 52 stones; 1927, 2,845 stones; 1928, 15 stones.

[2] Data not available.

[3] Includes Sakhalin.

[4] Content of MoS_2 reported as follows: 1926, 88 per cent; 1927, 85 to 87 per cent; 1928, not stated.

[5] Used mostly for calcination.

[6] Content of WO_3 reported as follows: 1925, not stated; 1926, 70 per cent; 1927, 60 to 71 per cent.

[7] Content of WO_3 reported as follows: For 17,620 tons, 30 to 68 per cent; for 39,630 tons, 60 to 70 per cent.

[8] Content of U_3O_8 reported as 1.5 to 3 per cent. Similar data not available for preceding years.

SALVADOR

The mines of Salvador at various times in the past have produced copper, gold, iron, lead, and silver-lead ores, but the Dirección General de Estadística de El Salvador states that no minerals have been produced in the country during the period 1924 to 1929, inclusive.

SEYCHELLES ISLANDS

The only mineral industry known to exist in the Seychelles Islands is the mining of phosphate rock, which apparently reached commercial proportions in 1925. The exports for the years 1925 to 1929, inclusive, were as follows:[56] 1925, 3,259 tons; 1926, 6,935 tons; 1927, 11,329 tons; 1928, 15,408 tons; 1929, 12,789 tons.

SIAM

Mineral production of Siam, 1924-1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Antimony ore .... tons	9					
Gems:						
Rubies [2] .... grams	[3] ($5,900)	[3] ($11,950)	[3] ($2,782)	[3] ($5,267)	([4])	[5] 1,447
Sapphires [2] .... do	[3] ($20,300)	[3] ($95,038)	[3] ($93,713)	[3] ($84,000)	([4])	[6] 1,339
Lead ore [2] .... kilograms			2,332			
Salt .... tons	([7])	126,086	125,670	115,356	119,332	[8] 177,070
Tin:						
Mine production .... do	[8] 7,952	[8] 7,862	7,607	7,706	7,694	10,686
Smelter production [9] .... do	419	296	204	45	3	
Tungsten concentrates .... do		109	9	8		[10] 57

[1] Source of data: Information supplied by the Royal Dept. of Mines, Siam, through the American consulate, Bangkok; publications of the Imp. Inst., London.

[2] Exports for year ended March 31 of year following that stated.

[3] Quantity not reported. Values converted from ticals to U. S. currency on the basis of 1 tical equals $0.3709.

[4] Data not available.

[5] Value reported as $6,305.

[6] Value reported as $14,317.

[7] Production not available. Exports for year ended March 31, 1925, reported as 10,564 tons.

[8] Data for year ended March 31 of year following that stated.

[9] Exports less imports for year ended March 31, of year following that stated.

[10] Exports.

SIERRA LEONE

The Geological Survey of Sierra Leone reports on the mineral deposits of the Colony as follows:[57]

Abrasives—corundum is widely distributed and to date five important deposits located, a deposit of emery occurs in talcose schists near Sandia; asbestos—several occurrences of chrysotile asbestos noted in serpentine, but nothing of economic value found as yet; bauxite—bauxite of medium quality noted in several places, the deposits owing to their favorable position are worthy of investigation; chromite—deposits discovered near Lago and Jalahun in Central Province and near Gorauwahun and Tuba in Southern Province, those near Lago being the richest and largest; coal—lignite is exposed at high-water level in several creeks west of Songo Town; gemstones—some alluvial diamonds recently discovered in the Kono district, small fragments of ruby associated with corundum also found in the district, and brilliant green chrome garnet found at Kenema; gold—alluvial gold is widely distributed in streams draining the Sula and Kangari hills; iron—extensive deposits of good quality ore found in the Koinadugu district, and smaller occurrences reported in numerous other localities; platinum—alluvial platinum found in many places; titanium—ilmenite is very abundant in the Headquarters district and in the beach sands of the Whale River estuary.

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[56] Figures for 1925 as published by Imp. Inst., London; those for 1926-1929, inclusive, supplied by the American consulate, Nairobi, Kenya Colony.

[57] Junner, N. R., Report of the Geol. Survey Dept., 1929, Freetown, 1930, pp. 7-11.

Iron and platinum are the only minerals reported as under commercial development during the period under review. The company owning the Marampa Concession is preparing to work its hematite deposits on a large scale; development work is in progress, and 150 men were employed throughout 1929 opening up quarry faces. Toward the end of October, 1929, mining operations were begun on the rich alluvial platinum deposits in the Big Water near York Pass, and 8,087 grams of crude platinum were produced.

SOMALILAND [58]

British Somaliland.—No mineral industry is known to exist in British Somaliland except the extraction of salt from sea water by evaporation. Deposits of copper, gypsum, limestone, mica, and petroleum have been reported, but none of these minerals have been exploited commercially so far as known. The annual output of salt is estimated to be about 15,000 tons.

French Somaliland.—The only mineral industry known in French Somaliland is the production of salt at Djibouti, where it is recovered from sea water by evaporation. Output is reported as follows: 1924, 1925, and 1926, approximately 15,000 tons; 1927, 18,444 tons; 1928, 39,000 tone; 1929, 38,972 tons.

Italian Somaliland.—No mineral deposit of any kind has yet been reported in Italian Somaliland. Salt is evaporated from sea water at the Hafun salt works, production being reported as follows: 1928, 1,656 tons; 1929, 4,347 tons.

SOUTH-WEST AFRICA

Mineral production of South-West Africa, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Copper-lead-zinc ore [b] ... tons	124,794	114,400	(c)	146,687	167,680	167,787
Copper-lead matte ... do	(c)	[d] 6,241	6,764	9,800	(c)	13,961
Fluorspar ... do	(c)	(c)	(c)	995	872	565
Gems:						
Beryls ... kilograms	----	----	----	34	----	----
Diamonds—number of stones	(c)	(c)	1,162,466	4,255,968	3,188,830	(c)
Diamonds—carats	492,696	515,860	683,801	723,877	503,142	597,059
Quartz, rose ... kilograms	----	----	----	7,820	3,800	----
Tourmalines, green ... grams	----	----	----	----	48,700	32,485
Gold, fine [e] ... do	4,572	55,364	52,907	30,606	16,827	13,530
Iron ore ... tons	5,835	14,161	17,869	21,753	29,929	28,697
Lead, (smelter product) [f] ... do	813	1,619	1,682	3,535	5,004	2,802
Lead-zinc-silver ore [g] ... do	(c)	223	145	128	12	----
Lepidolite ... do	----	----	----	----	----	31
Salt, rock ... do	340	432	363	343	146	334
Silver, fine [e] [f] ... kilograms	5,801	6,936	8,533	23,772	22,648	27,757
Tantalite ... do	----	----	----	----	282	----
Tin concentrates [h] ... tons	220	196	191	214	234	248
Vanadium concentrates [i] ... do	2,156	3,800	5,139	6,558	5,114	3,085

[a] Publications of the Imp. Inst., London; information supplied by Totten, R. J., American consul general, Cape Town, South Africa.

[b] Total mine production of copper is reported as follows for years ended March 31 of year following that stated: 1924, 8,021 tons; 1925, 8,300 tons; 1926, 8,900 tons; 1927, 10,700 tons; 1928, 11,300 tons; 1929, 12,600 tons.

[c] Data not available.

[d] Exports for years ended March 31 of year following that stated.

[e] Mine production.

[f] Data for year ended March 31 of year following that stated.

[g] Total mine production of lead is reported as follows for years ended March 31 of year following that stated: 1924, 4,602 tons; 1925, 1,446 tons; 1926, 17,400 tons; 1927, 20,100 tons; 1928, 26,700 tons; 1929, 25,900 tons. Similar data for zinc not available.

[h] Total mine production of tin reported as follows: 1924, 154 tons; 1925, 137 tons; 1926, 133 tons; 1927, 149 tons; 1928, 164 tons; 1929, 174 tons.

[i] Average content of V_2O_5 reported as follows: 1924, not stated; 1925, 18 per cent; 1926, 20 per cent; 1927 and 1928, 18 per cent; 1929, not stated.

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[58] Information supplied by the American consulate, Aden.

SPAIN

Mineral production of Spain, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Garnet ....tons	1,112	182	....	....	325	....
Tripoli ....do	404	868	804	358	250	204
Alum ....do	....	60	80	60	75	9
Aluminous earth (smectic clay) ....tons	300	135	192	1,102	457	168
Aluminum ....do	....	....	....	....	7	1,000
Alunite [2] ....cubic meters	....	(3)	(3)	(3)	310	600
Antimony ore ....tons	....	....	50	38	25	....
Asphalt rock ....do	5,476	5,580	5,856	4,514	7,735	9,002
Barite [4] ....do	14,450	8,784	7,941	7,716	6,163	5,806
Bauxite ....do	....	....	....	....	181	975
Bismuth:						
Ore [5] ....do	125	145	97	96	129	118
Metal ....kilograms	41,148	37,315	26,550	21,120	23,844	11,134
Bituminous rock (oil shale) [6] ....tons	....	67,500	....	54,337	54,110	54,900
Briquets, fuel ....do	627,014	670,974	686,707	803,127	846,645	921,906
Carbonaceous shale [7] ....do	....	....	....	....	5,760	9,000
Cement:						
Natural ....do	235,379	333,453	259,337	340,467	271,525	306,044
Portland ....do	681,689	802,314	924,107	1,112,404	1,270,800	1,513,967
Clay:						
Fire clay ....do	1,170	4,060	8,326	9,360	7,138	4,508
Kaolin ....do	3,287	4,855	312	7,635	[8] 2,083	700
Other clay ....cubic meters	223,870	447,676	355,647	730,580	782,621	822,678
Coal:						
Anthracite ....tons	316,190	316,038	402,857	429,896	389,393	499,744
Bituminous ....do	5,811,396	5,801,304	6,133,230	6,133,040	5,981,115	6,608,572
Lignite ....do	411,773	402,690	399,830	429,602	422,504	438,951
Coke:						
Gas-house ....do	132,995	16,788	138,471	161,256	204,476	216,218
Metallurgical ....do	724,082	861,130	693,739	714,243	680,555	768,040
Coke by-products:						
Ammonium sulphate ....do	10,793	12,189	13,776	17,194	21,638	25,559
Benzol ....do	7,172	6,998	7,602	9,014	10,734	10,911
Tar ....do	35,568	32,294	25,982	40,877	46,897	45,529
Copper:						
Ore ....do	283,866	327,282	286,642	380,983	353,156	408,260
Blister copper ....kilograms	13,297,000	17,224,000	18,101,664	20,241,893	16,840,000	17,032,058
Cement copper ....do	19,749,000	18,111,434	29,399,979	27,986,192	25,488,598	24,898,159
Electrolytic copper ....do	3,300,000	4,074,000	5,823,087	8,446,829	10,917,616	11,423,352
Copper sulphate ....do	7,357,539	4,095,000	4,679,230	6,859,201	7,993,055	8,190,000
Fluorspar [9] ....tons	4,474	2,436	14,011	757	2,082	13,478
Gold, fine [10] ....kilograms	30	30	30	30	23	15
Gold ore ....tons	260	....	....	....	....	....
Graphite ....do	....	1,945	603	352	....	....
Gypsum:						
Alabaster [11] ....do	197	368	110	122	122	122
Other gypsum [11] ....do	618,852	589,063	731,259	911,224	1,053,896	975,540
Iron:						
Ore ....do	4,612,817	4,442,872	3,181,589	4,960,394	5,771,207	6,546,648
Pig iron [12] ....do	510,279	530,029	488,696	593,070	562,821	752,618
Lead:						
Ore ....do	198,953	207,779	216,043	195,626	177,059	180,890
Metal (smelter product) ....kilograms	141,849,110	153,567,000	149,513,604	144,023,389	130,950,124	142,752,921
Manganese ore ....tons	20,840	36,072	44,947	36,870	13,704	17,872
Manganiferous iron ore ....do	11,975	14,159	9,032	11,311	13,566	12,414
Mercury:						
Ore ....do	15,192	22,593	30,008	51,353	76,731	36,278
Metal ....kilograms	898,699	1,277,337	1,594,168	2,492,999	2,195,121	2,476,294

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[1] Source of data: Estadistica Minera de España, Madrid (annual), except as otherwise noted.

[2] Used for production of alum.

[3] Data not available.

[4] Includes following quantities produced from quarries: 1924, 7,682 tons; 1925, 78 tons; 1926, 690 tons; 1927, 2,760 tons; 1928, 2,300 tons; 1929, none reported. This quarry product is reported in cubic meters, which have been converted to tons on the basis of 4.6 tons to the cubic meter.

[5] Average bismuth content reported as follows: 1924, 25.5 per cent; 1925 to 1927, inclusive, 20 per cent; 1928 and 1929, 33 per cent.

[6] Used for distillation of mineral oil.

[7] Used for manufacture of cement.

[8] Exclusive of following quantities of kaolinic sand: 1928, 9,525 cubic meters; 1929, 3,350 cubic meters.

[9] Includes the following quantities produced from quarries: 1924, 3,840 tons; 1925, 1,602 tons; 1926, 13,667 tons; 1927, 1928, and 1929, none reported. Reported in cubic meters, which have been converted to tons on the basis of 3.185 tons to the cubic meter.

[10] Figures as published by the Director, U. S. Mint.

[11] Converted to tons on the basis of 2.0321 tons to the cubic meter.

[12] Includes ferro alloys.

Mineral production of Spain, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Mineral paints:						
Lithopone..........tons..	----------	----------	----------	625	773	----------
Ocher, crude........do....	353	1,400	3,958	1,950	1,388	540
Red lead............do....	511	515	576	785	836	830
White lead..........do....	1,535	1,886	1,720	1,598	1,792	2,014
Phosphate rock..........do....	6,746	5,315	5,656	4,202	7,897	7,626
Potash:						
Crude salts..........do....	----------	27,734	80,598	172,356	243,233	243,949
Potassic earth.......do....	1,000	1,000	950	950	850	850
Pyrite:						
Arsenical pyrite [13]...do....	----------	----------	190	186	----------	----------
Cupreous pyrite.....do....	1,615,233	3,354,200	3,650,391	3,602,870	3,618,691	3,861,921
Iron pyrite..........do....	597,132	5,040	4,398	7,824	6,128	5,329
Salt:						
Rock salt............do....	105,450	106,627	118,581	110,839	146,147	164,837
Other salt...........do....	862,856	753,514	978,688	868,381	836,912	914,639
Sand:						
Glass sand..cubic meters..	1,007	21,500	20,000	24,250	21,000	21,000
Other sand..........do....	3,100	9,969	18,224	13,250	16,400	72,162
Silica (quartz)............tons..	15,176	31,301	19,388	4,540	8,177	17,940
Silver, fine........kilograms..	89,579	102,764	93,333	95,072	78,583	82,713
Silver ore...............tons..	405	47	----------	----------	----------	----------
Slate............cubic meters..	13,636	9,259	4,830	6,907	5,358	4,039
Sodium sulphate, natural ....tons..	10	7,750	13,502	9,080	7,416	10,016
Stone:						
Basalt......cubic meters..	1,333	1,570	8,000	7,290	39,360	19,330
Dolomite............do....	8,461	12,763	15,522	21,900	16,750	21,035
Granite..............do....	47,455	52,824	201,631	220,062	353,847	436,639
Limestone...........do....	657,694	921,847	1,082,091	1,299,328	1,432,875	1,418,042
Marble...............do....	10,482	13,441	8,520	8,415	8,670	13,227
Marls, for cement...do....	576,218	936,396	1,048,739	1,323,041	1,614,918	1,800,145
Sandstone...........do....	34,447	70,811	69,811	62,305	75,342	114,802
Other stone.........do....	30,075	73,951	125,849	205,356	194,968	240,960
Sulphur:						
Rock, crude..........tons..	64,650	61,916	64,867	75,830	76,731	74,201
Refined sulphur [14]..do....	18,577	17,042	19,454	19,804	21,329	23,967
Talc and soapstone......do....	1,977	1,771	1,658	3,843	5,302	5,164
Tin ore.................do....	94	224	545	4,329	454	566
Tungsten ore (wolfram).do....	200	73	148	197	189	255
Zinc:						
Ore [15]..............do....	116,721	167,939	201,335	132,178	122,141	144,883
Metal (smelter product) ....kilograms..	12,777,000	15,122,000	16,064,615	16,531,000	13,549,000	11,825,339

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[13] Arsenic content reported as 15 per cent.

[14] Includes the following quantities made from imported material: 1924, 9,037 tons; 1925, 9,057 tons; 1926, 9,953 tons; 1927, 9,576 tons; 1928, 10,966 tons; 1929, 12,064 tons.

[15] Average zinc content reported as follows: 1924, 35.91 per cent; 1925, 29.07 per cent; 1926, 29.29 per cent; 1927, 35.60 per cent; 1928, 36.77 per cent; 1929, 35.14 per cent.

SURINAM (DUTCH GUIANA)

Deposits of iron ore have been located in Surinam but have not been exploited. Unimportant deposits of quicksilver on the Maroni River have been worked in a small way, but data of output are not available. The chief mineral products of the colony are gold and bauxite, the output of which for the period under review is as follows:

Mineral production of Surinam, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Bauxite [2]..........................tons..	63,097	86,277	44,230	184,203	213,869	209,998
Gold, crude..........................grams..	322,671	308,533	258,608	239,796	170,553	110,721

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[1] Information furnished by the Governor of Surinam, Parimaribo.

[2] Exports of bauxite are reported as follows: 1924, 60,032 tons; 1925, 86,826 tons; 1926, 46,454 tons; 1927, 172,825 tons; 1928, 206,767 tons; 1929, 215,795 tons.

SVALBARD (SPITSBERGEN)

Mineral production of Svalbard, 1924–1929, in tons [1]

Island and mineral	1924	1925	1926	1927	1928	1929
Spitsbergen:						
Coal	[2] 431, 087	[2] 381, 542	[2] 291, 211	[2] 303, 372	275, 019	251, 185
Zinc ore [3]	27, 963	236	145	25		
Bear Island:						
Coal [2]	20, 827	31, 870				
Lead concentrates [4]			[5] 75		101	70

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[1] Source of data: Norges Bergverksdrift; information furnished by Dr. Adolf Hoel, lecturer on geology, Univ. of Oslo, through the American consulate, Oslo.

[2] Production less consumption at mines, for which data are not available.

[3] Average content of zinc reported as follows: 1924, 55.05 per cent; 1925, 64.8 per cent; 1926, 62 per cent; 1927, 60 per cent.

[4] Average content of lead reported as 70 per cent.

[5] Exports.

SWAZILAND

Deposits of asbestos, coal, gold, lead, mercury, monazite, tin, and tungsten are reported [59] in Swaziland, but the only minerals produced during the years under review are gold and tin. The output of these minerals is as follows:

Mineral production of Swaziland, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Gold, fine....grams..	11, 695	40, 714	46, 966	35, 302	10, 793	2, 799
Tin, metal [2]....tons..	174	197	135	108	132	132

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[1] Source of data: Imp. Inst., Statistical Summary, London (annual).

[2] Tin content of concentrates.

SWEDEN

Mineral production of Sweden, 1924–1929 [a]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Diatomite....tons..	608	819	475	622	721	589
Grindstones and whetstones....tons..	[b] ($7, 957)	[b] ($9, 934)	670	282	288	590
Millstones....do....	120	102	99	61	152	82
Aluminum [c]....do....	2	41	33	12	3	3
Alum shale:						
For cement....do....	317, 338	293, 301	1, 235	1, 007	2, 133	5, 905
For fuel....do....			293, 322	297, 097	277, 042	280, 263
For oil....do....			4, 781	2, 178		
Antimony [c]....do....	7	5	4	3		
Arsenic ore [d]....do....	80	110	13, 149	22, 100	22, 728	22, 919
Cement....do....	406, 665	446, 075	471, 210	496, 300	467, 991	569, 898
Chalk, washed....do....	12, 196	12, 637	15, 604	19, 562	18, 913	22, 452
Clay:						
Clinker clay....do....	37, 319	18, 507	45, 871	36, 312	36, 612	29, 545
Fire clay....do....	149, 072	119, 327	172, 936	179, 212	176, 603	215, 146
Coal....do....	437, 856	263, 879	383, 673	398, 298	358, 513	394, 975
Cobalt, metallic [e]....kilograms..		5, 330	3, 726	4, 590	3, 319	5, 309
Coke:						
Gas-house....tons..	185, 952	188, 140	209, 153	223, 755	252, 934	284, 014
Metallurgical....do....	79, 328	77, 369	112, 542	115, 756	104, 805	103, 778

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[a] Source of data: Sweden, Kommerskollegium. Bergshantering; Industri, Stockholm (annual).

[b] Quantity not reported. Value converted from kronor at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[c] Produced from scrap.

[d] Arsenic content reported as follows: 1924, 19 tons; 1925, 21 tons; 1926, 2,478 tons; 1927, 4,420 tons; 1928, 4,546 tons; 1929, 4,584 tons.

[e] Produced from foreign materials.

[59] Bond, G. W., Notes on the Mineralized Belt of the Jamestown Series, Forbes Reef, Northern Swaziland: Geol. Soc. So. Africa, Trans., vol. 32, Johannesburg, 1930, pp. 177–186, Min. and Ind. Mag. So. Africa, vol. 9, No. 3, Johannesburg, 1929, p. 83, The Komati Coal Fields: So. African Min. and Eng. Jour., vol. 32, pt. 1, Johannesburg, 1921, pp. 1308, 1361. Garrard, J. J., The Geology of the Swaziland Coal Field: Geol. Soc. So. Africa, Trans., vol. 17, Johannesburg, 1915, pp. 75–84.

Mineral production of Sweden, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Copper:						
Ore [f] ... tons	174	680	40	217	56	2,753
Refined copper [g] ... kilograms	2,143,000	3,828,000	4,006,000	5,552,000	3,629,000	4,925,000
Feldspar:						
Ground ... tons	434	507	420	1,385	3,004	3,824
Unground ... do	18,875	26,244	33,550	29,251	36,917	35,268
Gold [h] ... grams	9,000	18,000	460,000	774,000	900,000	1,089,000
Gypsum ... tons	223	128	137	89	116	122
Iron:						
Ore ... do	6,499,730	8,168,546	8,465,914	9,660,977	4,668,801	11,467,551
Pig iron [i] ... do	532,604	458,535	494,663	454,518	437,512	523,829
Sponge iron ... do	589	(j)	(j)	(j)	(j)	(j)
Lead:						
Ore (silver-lead) [k] ... do	2,777	3,252	3,987	7,428	5,687	11,889
Refined and soft lead [l] ... kilograms	671,000	817,000	563,000	415,000	16,000	72,000
Lime ... hectoliters	4,003,144	4,115,814	4,377,647	4,372,358	4,372,358	4,830,777
Manganese ore ... tons	10,881	10,941	15,258	16,823	15,790	14,609
Mica ... do	4	95	53	10	12	66
Mineral oil [m] ... kilograms	------------	12,250	51,000	21,657	------------	------------
Peat:						
For fuel ... tons	83,884	83,900	59,565	74,731	53,375	45,786
Litter, baled ... do	110,694	132,089	141,174	125,918	107,004	121,244
Litter and "mull," unbaled ... cubic meters	32,103	28,769	54,031	77,526	49,512	76,406
"Mull," baled ... tons	17,268	19,400	21,671	21,432	19,253	20,494
Powdered peat ... do	7,701	6,700	7,490	9,660	7,904	7,030
Platinum [e] ... grams	------------	4	4	3	2	3
Pyrite ... tons	66,353	69,873	69,759	69,239	19,996	72,055
Silica:						
Flint—						
Rough ... do	4,735	10,960	15,630	11,574	8,294	12,017
Other ... do	334	379	394	364	449	395
Quartz—						
Ground ... do	2,320	1,726	2,271	2,533	2,643	3,079
Unground ... do	51,721	50,672	40,347	62,280	76,139	69,640
Silver [h] ... kilograms	26	1,717	2,500	5,614	2,129	4,533
Slate:						
Roofing slate ... tons	1,100	1,200	1,400	1,140	1,130	1,556
Other ... do	[b] ($4,962)	[b] ($8,477)	[b] ($9,566)	[b] ($13,454)	[n] 721	[n] 1,154
Stone:						
Granite and gneiss—						
Building stone ... do	11,952	12,898	20,740	16,613	15,832	21,653
Flagstones ... do	50,761	69,623	54,259	84,983	883,061	859,952
Macadam, blocks, etc ... tons	320,130	317,148	348,885	398,183	497,640	463,400
Paving stones ... do	617,780	848,648	396,448	809,957	97,983	99,806
Other ... do	[o] 4,648	[o] 4,470	[o] 5,503	7,131	6,291	7,800
Granite, so-called black or green—						
Blocks, rough ... tons	19,890	36,105	38,789	41,294	52,814	61,229
Dressed stone ... do	2,437	2,741	2,816	3,107	3,102	3,224
Limestone and dolomite—						
Building and monument stone ... tons	11,125	12,074	11,240	9,771	9,828	11,948
Crushed and broken stone ... tons	27,444	81,657	69,802	101,423	87,612	155,294
Ground stone ... do	40,533	39,972	46,536	43,230	42,398	44,002
Rough stone ... do	512,758	534,711	541,100	531,013	610,477	713,368
Other ... do	[b] ($17,683)	[b] ($20,176)	[b] ($29,339)	380	382	515
Marble—						
Blocks, rough ... do	61	82	111	134	360	628
Building and monument stone ... tons	1,095	2,236	3,610	4,917	5,236	7,428
Other ... do	[b] ($251,495)	[b] ($243,077)	[b] ($290,770)	1,642	1,786	1,955

[b] Quantity not reported. Value converted from kronor at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[e] Produced from scrap.

[f] Total mine production of copper is reported as follows: 1924, 18 tons; 1925, 213 tons; 1926, 709 tons; 1927, 783 tons; 1928, 619 tons; 1929, 1,128 tons.

[g] Includes the following quantities made from scrap: 1924, 138,075 kilos; 1925, 101,000 kilos; 1926, 212,000 kilos; 1927, 146,000 kilos; 1928, 233,000 kilos; 1929, 177,000 kilos.

[h] Mine production.

[i] Includes ferro-alloys.

[j] Data not available.

[k] Total mine production of lead reported as follows: 1924, 1,891 tons; 1925, 2,637 tons; 1926, 3,167 tons; 1927, 4,867 tons; 1928, 3,337 tons; 1929, 7,036 tons.

[l] Includes the following quantities made from scrap: 1924, 194,000 kilos; 1925, 94,000 kilos; 1926, 41,000 kilos; 1927, 85,000 kilos; 1928, 16,000 kilos; 1929, 72,000 kilos.

[m] Distilled from alum shale.

[n] Values reported as follows: 1928, $22,387; 1929 $31,813.

[o] Exclusive of small quantity for which value only is reported as follows: 1924, $30,448; 1925, $38,442; 1926, $32,199.

Mineral production of Sweden, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Stone—Continued.						
Porphyry, rough and monument stone..tons..	....	....	50	202	....	41
Quartzite—						
Rough stone.......do..	81, 217	11, 370	10, 387	10, 421	16, 613	11, 285
Broken stone, etc..do..	70, 119	65, 906	67, 787	54, 907	54, 783	60, 027
Sandstone—						
Building and monument stone.....tons..	185	5	28	88	50	63
Rough stone.......do..	5, 972	5, 746	5, 923	4, 433	5, 983	5, 200
Other..............do..	2, 200	2, 200	5, 768	7, 230	7, 108	7, 310
Shale, ground.......do...	1, 350	1, 275	2, 160	2, 000	2, 223	1, 471
Talc and soapstone:						
Building and monument stone...............tons..	1, 018	1, 046	1, 258	1, 367	1, 412	2, 024
Powdered stone.....do....	1, 855	1, 078	1, 535	1, 503	1, 096	1, 552
Rough stone, blocks..do....	....	250	428	225	1, 900	3, 000
Other....................	[2] ($92, 563)	[2] ($95, 579)	[2] ($72, 462)	380	468	450
Tin, metallic [3]............tons..	3	2	4	6	3	3
Zinc:						
Ore [16]................do....	47, 691	51, 183	56, 267	62, 526	34, 101	72, 257
Refined and commercial zinc [17].......kilograms..	3, 521, 000	4, 747, 000	4, 800, 000	4, 681, 000	5, 139, 000	4, 772, 000

[2] Quantity not reported. Value converted from kronor at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[3] Produced from scrap.

[16] Total mine production of zinc reported as follows: 1924, 17,139 tons; 1925, 18,636 tons; 1926, 21,307 tons; 1927, 24,372 tons; 1928, 14,172 tons; 1929, 29,992 tons.

[17] Includes the following quantities made from scrap: 1924, 70,000 kilos; 1925, 75,000 kilos; 1926, 34,000 kilos; 1927, 34,000 kilos; 1928, 33,000 kilos; 1929, 54,000 kilos.

SWITZERLAND

Almost every known mineral is said to occur in Switzerland, but the geological formation of the country is such that in most cases exploitation is not profitable. Mining operations are irregular, and official statistics of output are not recorded.

Asbestos is mined intermittently, but the deposits are small and the output is unimportant. Available reserves of asphalt are estimated at 1,000,000 tons. Small deposits of barite and fluorspar are known, but the output therefrom is negligible. Small quantities of anthracite coal and lignite are mined. Large beds of gypsum occur and are worked, mainly for domestic consumption. Iron ore is mined at Gonzen, Canton of St. Gall. There is no smelter in the vicinity of the iron mines, and the ore is shipped abroad. Peat beds of considerable extent exist and are worked intermittently. Slate and stone are abundant and of excellent quality.[60] The only annual figures available on the mineral industry of Switzerland from 1924 to 1929 are given in the following table:

Mineral production of Switzerland, 1924–1929, in tons [a]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt [b] [c]................................	33, 159	35, 757	28, 200	36, 716	21, 321	20, 069
Coal [d].....................................	7, 000	7, 000	7, 000	7, 000	7, 000	7, 000
Coke, gas-house..............................	([e])	([e])	([e])	333, 231	347, 374	382, 111
Coke by-products:						
Ammonium sulphate..........................	([e])	([e])	1, 084	642	951	532
Tar..	([e])	([e])	([e])	24, 608	25, 978	27, 278
Gypsum: [b]						
Crude [f]..................................	749	74	589	1, 246	1, 231	1, 691
Ground and calcined........................	363	114	106	20	33	84
Iron ore [b].................................	81, 375	59, 513	49, 995	81, 661	65, 702	88, 445
Salt...	71, 815	75, 141	77, 267	78, 262	79, 982	86, 476

[a] Source of data: Switzerland, Direction Générale des Douanes Fédérales, Statistique du Commerce de la Suisse avec l'Etranger, Bern (annual); Imp. Inst., Statistical Summary, London (annual); information supplied by the American consulate, Zurich.

[b] Exports.

[c] Annual production ranges from 25,000 to 50,000 tons.

[d] Approximate annual production.

[e] Data not available.

[f] Some limestone is included.

[60] Information supplied by L. W. Haskell, American consul general, Zürich.

SYRIA

The mineral resources of the French Mandate of Syria, which comprises the Republic of Syria, the Lebanese Republic, the State of the Alaouites, and the Djebel Druse Territory, are reported [61] to include asbestos, asphalt rock, bitumen, chromite, coal, copper, gold, gypsum, iron, lead, magnesite, manganese, marble and other building stones, nickel, ocher, pandermite, petroleum, phosphate rock, pyrite, salt, silver, sulphur, tin, and titanium (ilmenite). With the exception of asphalt and salt, however, none of these minerals have as yet given rise to an industry of commercial importance.

Equipment of the asphalt quarries at Kfarée in the State of the Alaouites was completed in 1929, and the initial production is expected to reach 30,000 tons of asphalt. Salt is very abundant throughout the Syrian Desert, and it is also extracted from salt lakes near Aleppo. The annual output of salt is estimated at 10,000 tons.

A considerable deposit of asbestos is reported near Alexandretta, but to date no exploitation has been attempted. Very pure bitumen is found in Lebanon, and a small output has been reported. The lignites of Lebanon were mined during the World War, but the mines are now abandoned. Placer gold is washed by the natives in the plain of Antioch. The lead occurrences southwest of Damascus are worked by the natives on a small scale, and veins of silver-lead have been found on Mount Amanus. Magnesite (giobertite) has also been found in the serpentines of this locality. Manganese ore was at one time mined on the slopes of the Djebel Akra, but no information on output is available. A nickel-bearing deposit occurs at Djebel Akra. The petroleum indications in northeastern Syria are promising. Some prospecting has been done, but development of the industry on a commercial scale has not been encouraged. Muds very rich in sulphur are exploited by the Arabs in the northeastern area. Tin deposits in the Kesserwan district were examined and approved by Australian engineers before the World War, but the work was discontinued then and has not been resumed. Ilmenite is found in the black sands of the coast, the content of the sands being reported as 26 per cent of titanium oxide.

TANGANYIKA TERRITORY

Mineral production of Tanganyika Territory, 1924–1929 [a]

Mineral [b]	1924	1925	1926	1927	1928	1929
Gems:						
Diamonds............carats..	----------	411	6, 695	18, 766	24, 681	24, 432
Garnets............kilograms..	----------	----------	----------	23	39	(c)
Gold, fine [d]............grams..	242, 483	314, 767	251, 409	296, 914	398, 529	282, 140
Graphite............tons..	----------	----------	----------	----------	6	----------
Mica............do....	56	69	53	43	34	29
Mineral paint ores: Ocher............do....	7	3	7	32	61	47
Salt............do....	4, 629	4, 000	3, 155	4, 852	5, 134	7, 387
Silver, fine [d]............kilograms..	----------	31	25	29	49	32
Tin concentrates [e]............tons..	----------	30	25	49	51	[f] 19

[a] Source of data: Publications of the Imp. Inst., London; data supplied by the Controller of Mines, Tanganyika Territory, through the American consulate, Nairobi, Kenya Colony.

[b] In addition to the minerals listed, asbestos, bitumen, coal, copper, iron ore, manganese, nickel, marble, and uranium are reported to occur. (Francke, P., Die bergbauliche Entwicklung des Tanganjika Territoriums: Glückauf, Jahrg. 60, 1924, pp. 1086–1089.)

[c] Data not available.

[d] Mine production.

[e] The total mine production of metallic tin is reported as follows: 1925, 7 tons; 1926, 18 tons; 1927, 37 tons; 1928, 38 tons; 1929, 14 tons.

[f] Exports.

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[61] Rüe, E. Aubert de la, Les ressources minérales des états du Levant sous mandat français: Mines t Carrières, Oct. 1931, pp. 6–11. Information supplied by the American consulate at Beirut and at Aleppo, yria. Toll, I. M., The Mineral Resources of Syria: Eng. and Min. Jour. vol. 112, No. 22, 1921, p. 846.

TRINIDAD

Mineral production of Trinidad, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt .... tons..	227, 460	204, 335	241, 109	246, 017	199, 125	223, 128
Petroleum, crude. hectoliters	6, 451, 068	6, 975, 687	7, 905, 931	8, 556, 337	12, 220, 273	13, 860, 153
Stone Limestone and road material [2] .... tons..	201, 268	202, 890	170, 851	193, 407	195, 656	245, 256

[1] Source of data: Administration report, Inspector of Mines, Trinidad.

[2] Includes gravel.

TUNISIA

Mineral production of Tunisia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Cement, natural ..... tons..	(2)	150	1, 500	(2)	(2)	(2)
Clay .... do....	57, 650	97, 600	92, 250	86, 870	87, 000	108, 470
Coal, lignite .... do....	305	....	....	....	....	....
Copper ore [3] .... do....	163	....	....	84	....	....
Gypsum, crude .... do....	20, 000	11, 600	13, 070	16, 000	16, 000	19, 540
Iron ore .... do....	797, 680	724, 000	582, 000	915, 000	909, 000	977, 000
Lead:						
Ore [4] .... do....	40, 000	38, 000	37, 000	37, 000	34, 000	32, 000
Work lead..... kilograms..	14, 291, 000	16, 013, 000	18, 106, 000	18, 662, 000	17, 606, 000	18, 850, 000
Lime:						
Hydraulic lime ..... tons..	39, 400	38, 650	45, 500	33, 600	60, 000	55, 000
Quicklime .... do....	15, 300	(2)	(2)	22, 400	(2)	(2)
Manganese ore [5] .... do....	3, 220	1, 655	1, 550	2, 056	2, 200	200
Phosphate rock .... do....	2, 391, 000	2, 691, 000	2, 568, 000	3, 075, 000	2, 789, 000	2, 511, 000
Salt .... do....	123, 606	128, 442	132, 080	144, 788	114, 045	120, 165
Sand and gravel .... do....	85, 500	(2)	107, 650	116, 500	116, 000	238, 140
Stone:						
Building stone, dressed .... tons..	(2)	(2)	2, 176	1, 110	1, 000	16, 670
Flagstones .... do....	(2)	(2)	1, 320	940	900	1, 798
Limestone for lime and other industrial uses .... tons..	73, 750	83, 100	90, 450	100, 000	(2)	(2)
Paving stones .... do....	(2)	(2)	7, 960	6, 450	....	9, 680
Rubble, ballast material, etc .... tons..	(2)	(2)	714, 413	631, 150	651, 000	680, 138
Zinc ore [6] .... do....	14, 000	22, 000	30, 000	18, 000	10, 000	10, 000
Zinc-lead ore [7] .... do....	....	9, 000	7, 000	9, 000	....	....

[1] Source of data: Statistique de l'Industrie Minérale en France et en Algérie, Paris; data furnished by Service des Mines, Tunisia.

[2] Data not available.

[3] Average copper content reported as follows: 1924, 8 to 10 per cent; 1927, 14 per cent.

[4] Average lead content reported as follows: 1924, 50 per cent; 1925, 55 to 58 per cent; 1926, 53 per cent; 1927, 50 per cent; 1928, not stated; 1929, 50 per cent.

[5] Average manganese content reported as follows: 1924, 30 to 40 per cent; 1925, 34 to 36 per cent; 1926 and 1927, 35 to 40 per cent; 1928, not stated; 1929, 35 per cent.

[6] Average zinc content reported as follows: 1924, 35 per cent; 1925, 34 to 35 per cent; 1926, 30 per cent; 1927, 35 per cent; 1928, not stated; 1929, 40 per cent.

[7] Average content reported as follows: 1925, zinc, 15 to 16 per cent; lead, 4 to 6 per cent; 1926, zinc, 15 to 18 per cent; lead, 4 to 8 per cent; 1927, zinc, 15 to 18 per cent, lead, 5 to 6 per cent.

TURKEY

No comprehensive mineral survey of Turkey has ever been made, and knowledge of the mineral resources of the country is therefore meager. The mineral wealth of Asiatic Turkey is generally believed to be great, and that of Turkey in Europe inconsiderable. Some deposits of lignite and petroleum are reported in European Turkey, but none have given rise to any considerable commercial development. Deposits of the following minerals [62] are known in Asia Minor, and many of them have been worked for centuries: Alum, antimony, arsenic, borax, chromite, clay, coal, cobalt, copper, emery, fuller's earth, gold, gypsum, iron, lead and silver-lead, manganese, meerschaum, mercury, pandermite (calcium borate), petroleum, phosphate rock, platinum, salt, silver, sulphur, and zinc.

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[62] Krümmer, A., Die türkische Bodenschätze: Archiv für Lagerstättenforsch., No. 37, Berlin, 1928, 17 pp.; Ravndal, G. B., Turkey, A Commercial and Industrial Handbook: U. S. Bur. For. and Dom. Com. Trade Promotion Ser. 28, 1926, pp. 126–159.

Coal and lignite are widely distributed throughout Asia Minor; but the center of the coal-mining industry is in the Heraclea Basin, where great beds of bituminous coal have been mined for many years.

Copper occurs in numerous localities; but the deposits of Argana Maden, which are reputed to be enormous and remarkably rich, have been the center of interest and overshadow all others. The workings date back to antiquity, and the mines are still regarded as the most valuable in the country.

The emery mines of Smyrna are very productive and rank next in importance to those of Naxos as the source of the world's supply of this abrasive.

The following table gives such data of the mineral production of Turkey as are available for the period under discussion.

Mineral production of Turkey in Asia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Emery .... tons	6,108	7,500	4,574	6,620	11,135	7,603
Grindstones .... number	(2)	13,313	18,426	10,122	5,929	2,740
Antimony, metallic [3] .... tons	------	74	------	25	98	7
Arsenic ore .... do	------	------	------	------	10	14
Boracite .... do	11,000	16,051	15,574	17,881	14,943	13,528
Boric acid .... do	(2)	(2)	[4] 4,577	[4] 6,620	(2)	(2)
Cement .... do	(2)	(2)	(2)	40,973	5,800	47,250
Chromite .... do	3,400	7,506	6,670	18,318	11,849	15,078
Coal:						
Bituminous .... do	1,088,584	[5] 769,718	1,222,387	[5] 896,074	[5] 923,403	[5] 985,035
Lignite [6] .... do	701	4,062	7,569	6,555	5,169	7,659
Copper:						
Ore .... do Metal .... kilograms	(7)	(7)	(7)	(7)	(7)	(7)
Fuller's earth .... tons	500	2,555	7,177	7,276	5,913	5,831
Gold, fine [8] .... grams	(2)	(2)	(2)	[9] 30,000	28,000	[9] 28,000
Lead (smelter product) .... kilograms	[10] 5,104,000	[10] 4,786,000	5,508,901	6,530,940	8,062,240	7,324,170
Magnesite, crude .... tons	------	------	------	------	------	196
Manganese ore .... do	43	98	77	11,398	61	151
Meerschaum [11] .... do	(11)	------	(11)	(11)	(11)	(11)
Mercury, metallic .... kilograms	7,688	3,402	5,511	------	2,994	8,131
Salt [3] .... tons	100,000	100,000	100,000	100,000	100,000	100,000
Silver, fine [8] .... kilograms	(2)	(2)	(2)	[9] 7,000	6,843	[9] 6,843
Sulphur .... do	(2)	(2)	(2)	49,786	(2)	(2)
Zinc concentrates .... tons	------	------	------	------	5,729	11,501

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[1] Source of data: Turkey, Office Central de Statistique, Annuaire Statistique, Ankara (annual); information furnished by the Director General of Mines of Turkey, through the American delegate at Ankara; other sources as noted.

[2] Data not available.

[3] Content of ore.

[4] Figures as published by Imp. Inst., London, converted to metric tons.

[5] Shipments.

[6] In addition to the production shown for Turkey in Asia, the following quantities of lignite are reported as produced in Turkey in Europe: 1925, 2,000 tons; 1926, 4,638 tons; 1927, 4,000 tons; 1929, 312 tons.

[7] Copper ore is produced and copper smelted in Turkey in Asia, but data of output are not available.

[8] Figures as published by the Director, U. S. Mint.

[9] Approximate production.

[10] Figures as published by American Bureau of Metal Statistics.

[11] Production reported as follows in "Cases," weight not stated: 1924, 1,779 cases; 1926, 323 cases; 1927, 512 cases; 1928, 41 cases; 1929, 295 cases.

UGANDA PROTECTORATE

The Geological Survey of Uganda reports the economic mineral possibilities of Uganda as follows:[63]

Abrasives—diatomite reported from a locality 8 miles west of the mouth of the Katonga River; antimony—the first, and as yet only occurrence, reported near the Tanganyika border; arseno-pyrite (mispickel)—found in Ankole and in the Mabira forest; asbestos—small deposits of little economic value reported in Ankole and on Mt. Ruwenzori, a more promising occurrence found in the West Nile district; bauxite—widely distributed in Uganda, but lack of transportation impairs present value of deposits; beryl—reported from two localities in Ankole; bismuth—occurs in the form of bismutotantalite at Gamba Hill, 35 miles northwest of Entebbe; chromite—occurs but not in large quantities; clays—kaolin is of wide occurrence, the Karroo beds yield good pottery clays, and brick clays are found in some swamps; coal—two small coal basins are known on the Entebbe peninsula and a very much larger basin exists in the Bugiri district of the Eastern Province, lignite has been found in the banks of the Kisegi River immediately north of Ruwenzori; copper—reported by the Italian geologist, A. Roccati, as plentiful on Mount Stanley, and promising deposits discovered in 1927 at Kilembe in a tributary valley of the Namwamba River; gold—widely distributed, but payable quantities not proved; graphite—deposits found near Kigarobya near Bunyoro, in the Kigezi district, and in Ankole and Karamojo, generally in the form of graphite schist; iron—some remarkably fine iron ores reported and in abundant supply; kyanite—widely distributed; lead—reported from Bunyoro and Ruwenzori in the form of galena; manganese—occurs in Uganda, but pending higher prices and cheaper transportation commercial importance small; mica—three chief varieties occur, but only muscovite found in large crystals; monazite—of wide distribution but known in quantity at only two places; petroleum—seepages found in several localities in the Albertine depression; potash—believed that the saline deposits of the Western Province will yield potash salts; salt—alluvial deposits known in several localities, largest producing centers at Kibero and Katwe; talc—highly talcose rocks found in the West Nile district and at Nampunge, 10 miles north of Kampala; tantalite—found in association with tin and bismuth; tin—search for alluvial deposits has not yet met with much success, rich eluvial deposits, however, have been found at or near hilltops, and geologic conditions seem to indicate that tin lodes probably occur in the hills; titanium—rutile occurs, generally coarse and sometimes in crystals, ilmenite is common and of wide distribution; zircon—occurs widely but has been found in quantity only at Karamoja.

The only minerals reported as produced are tin and salt for which data are as follows:

Production of salt and tin in Uganda Protectorate, 1926–1929, in metric tons[1]

Mineral	1926	1927	1928	1929
Salt	1,743	2,049	2,067	2,280
Tin concentrates (exports)[2]	----------	117	279	329

[1] Source of data: Publications of the Imp. Inst., London. No production reported prior to 1926.
[2] Tin content reported as follows: 1927, 81 tons, 1928, 189 tons; 1929, 229 tons.

UNION OF SOUTH AFRICA

Mineral production of the Union of South Africa, 1924–1929[a]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives:						
Corundum .... tons	1,695	1,662	5,439	965	1,832	3,272
Diatomite .... do	236	----------	----------	----------	----------	----------
Arsenic, white .... do	102	33	38	53	17	33

[a] Source of data: Union of South Africa, Dept. of Mines, Ann. Rept. of the Government Mining Engineer, Pretoria (annual), except as otherwise noted.

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[63] Uganda, Geological Survey, Annual Report 1920, 1925, and 1929, Entebbe. Wayland, E. J., Petroleum in Uganda: Mem. 1, Entebbe, 1925.

Mineral production of the Union of South Africa, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Asbestos:						
Amosite asbestos___tons__	(2)	(2)	2, 667	4, 620	6, 122	8, 400
Blue asbestos_______do____	(2)	(2)	3, 651	4, 421	4, 666	5, 470
Chrysotile asbestos_do____	(2)	(2)	6, 471	11, 044	11, 033	16, 100
Total_____________do____	6, 569	9, 224	12, 789	20, 085	21, 821	29, 970
Cement________________do____	307, 062	280, 295	324, 951	327, 907	331, 404	361, 602
Chromite [3]_____________do____	4, 572	13, 756	12, 042	16, 959	31, 756	63, 974
Clay: Kaolin___________do____	1					
Coal__________________do____	11, 819, 988	12, 321, 728	12, 949, 950	12, 580, 314	12, 606, 576	13, 018, 328
Coal by-products:						
Ammonium sulphate _________________do____	772	904	911	856	957	1, 056
Tar_________hectoliters__	10, 783	16, 359	19, 679	21, 716	24, 076	24, 618
Cobalt ore______________tons__						3
Coke, metallurgical_____do____	67, 561	67, 829	80, 312	98, 249	94, 089	99, 297
Copper:						
Ore treated_________do____	166, 673	199, 462	209, 399	228, 908	208, 095	240, 242
Metal (smelter output) _____________kilograms__	9, 300, 409	8, 543, 821	8, 905, 786	9, 323, 996	8, 848, 634	9, 308, 573
Feldspar________________tons__			101	29	30	
Fluorspar_______________do____	10, 192	4, 883	8, 403	7, 582	5, 582	2, 715
Gems:						
Beryl_____________carats__					(4) ($15, 533)	49, 887 ($78, 711)
Diamonds__________do____	2, 440, 398	2, 430, 128	3, 217, 967	4, 708, 038	4, 372, 857	3, 661, 212
Jade [4]____________________	($1, 427)					($185)
Gold, fine____________grams__	297, 817, 075	298, 518, 520	309, 627, 751	314, 844, 706	322, 053, 654	323, 859, 584
Graphite________________tons__	50	47	46	58	51	53
Gypsum_________________do____	9, 219	7, 237	11, 389	15, 430	14, 871	17, 245
Iron:						
Ore________________do____			47, 200	77, 523	20, 898	38, 270
Pig iron____________do____			20, 382	30, 610	9, 057	16, 510
Lead:						
Concentrates [5]______do____	(2)	1, 946	368	288	53	63
Metal (smelter product) _____________kilograms__	4, 609, 382					
Magnesite______________tons__	2, 001	1, 823	1, 884	1, 839	1, 481	1, 709
Manganese ore__________do____	930	471	835	1, 300		9, 349
Mica___________________do____	735	1, 462	872	1, 454	3, 419	1, 464
Mineral paint ores______do____	288		275	861	347	383
Natural gas (carbon dioxide) [4]_					($4, 136)	($4, 400)
Platinum metals:						
Osmiridium, fine [6]__grams	179, 280	170, 758	193, 712	170, 229	176, 388	180, 711
Platinum [7]—						
Crude platinum [8] _____________do____			360, 241	542, 103	680, 637	1, 458, 847
Concentrates [9]__tons__			160	482	737	286
Total estimated content of platinum metals____grams__			327, 986	608, 695	736, 002	927, 319
Pyrite, iron_____________tons__	2, 349	2, 512	2, 448	2, 254	3, 754	4, 116
Salt [10]__________________do____	70, 369	59, 269	80, 517	79, 400	83, 735	88, 856
Silver, fine________kilograms__	434, 498	361, 258	305, 229	314, 685	320, 794	320, 918
Slate [4]______________________	($24, 634)	($27, 496)	($31, 438)	($41, 834)	($37, 601)	($92, 397)
Soda___________________tons__	318	1, 716	1, 680	2, 119	2, 535	2, 555
Stone for building, curbing, etc.[4]:						
Granite__________________	($388, 450)	($270, 189)	($91, 573)	($93, 866)	($125, 140)	($107, 998)
Limestone________________	($3, 383)	($5, 162)	($6, 986)	($24, 777)	($29, 402)	($37, 874)
Sandstone________________	($186, 705)	($110, 351)	($111, 365)	($100, 404)	($116, 619)	($141, 379)
Talc and soapstone______tons__	575	60	76	307	541	464
Tin concentrates [11]______do____	1, 786	1, 763	1, 657	1, 735	1, 879	1, 856
Verdite_________________do____			105			

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[2] Data not available.

[3] Average content of Cr_2O_3 reported as follows: 1924, 43.06 per cent; 1925, 42.45 per cent; 1926, 42.06 per cent; 1927, 42.53 per cent; 1928, 42.28 per cent; 1929, 42.58 per cent.

[4] Quantity not reported. Values converted from pounds sterling at the annual average rate of exchange as published by the U. S. Federal Reserve Board.

[5] Average lead content reported as follows: 1925, 74.28 per cent; 1926, 76.84 per cent; 1927, 82.89 per cent; 1928; 77.78 per cent; 1929, 81.36 per cent.

[6] Produced on the Rand from gold ores.

[7] Produced from working the "Bushveld Igneous Complex" and the hortonolite dunite deposits of the Potgietersrust and Lydenburg districts.

[8] Estimated content of platinum metals reported as follows: 1926, 271,316 grams; 1927, 402,510 grams; 1928, 455,853 grams; 1929, 749,065 grams.

[9] Estimated content of platinum metals reported as follows: 1926, 56,670 grams; 1927, 206,185 grams; 1928, 280,149 grams; 1929, 178,223 grams.

[10] Year ended June 30 of year stated. Data supplied by the Board of Trade and Industries, Pretoria, through the American consulate, Johannesburg.

[11] Average tin content reported as follows: 1924, 66.06 per cent; 1925, 66.09 per cent; 1926, 68.12 per cent; 1927, 67.18 per cent; 1928, 67.54 per cent; 1929, 66.66 per cent.

Mineral production of the Union of South Africa, 1924–1929, by Provinces

Province and mineral	1924	1925	1926	1927	1928	1929
CAPE OF GOOD HOPE						
Asbestos, blue........tons..	2, 723	2, 304	3, 623	4, 379	4, 606	5, 470
Coal..................do....	5, 288	4, 486	4, 666	4, 088	4, 503	4, 402
Copper:						
Ore treated..........do....	35, 113	42, 544	48, 783	53, 956	31, 748	35, 673
Copper (smelter output) ....kilograms..	2, 894, 811	2, 742, 405	2, 976, 458	2, 614, 493	2, 585, 463	2, 268, 857
Gems: Diamonds.....carats..	1, 290, 119	1, 248, 321	1, 231, 914	1, 296, 248	2, 134, 063	1, 482, 083
Gold, fine..............grams..	93	----------	----------	----------	----------	----------
Gypsum [1]...................	($45, 752)	($39, 109)	($68, 724)	($89, 555)	($64, 409)	($72, 168)
Lead concentrates [2].....tons..	225	178	245	44	----------	----------
Manganese ore [3].........do....	----------	----------	----------	726	----------	9, 349
Stone for building, etc.: [4]						
Granite.....................	($45, 902)	($46, 696)	($33, 070)	($28, 845)	($32, 472)	($31, 055)
Sandstone...................	($10, 442)	($5, 370)	($10, 056)	($6, 660)	($9, 980)	($19, 699)
Tin concentrates [5]......tons..	----------	----------	8	----------	----------	23
NATAL						
Asbestos, chrysotile.....tons..	----------	----------	----------	----------	----------	21
Clay: Kaolin............do....	1	----------	----------	----------	----------	----------
Coal.....................do....	4, 478, 265	4, 404, 325	4, 865, 683	4, 585, 260	4, 381, 805	4, 723, 352
Coal by-products:						
Ammonium sulphate ....tons..	772	904	911	856	957	1, 056
Tar...........hectoliters..	9, 969	6, 891	10, 369	11, 852	14, 538	14, 447
Coke, metallurgical.....tons..	67, 433	67, 804	80, 178	98, 222	94, 089	99, 297
Gold, fine..............grams..	3, 702	591	----------	995	1, 493	----------
Iron ore.................tons..	----------	----------	47, 200	77, 523	20, 898	38, 270
Mineral paint ores......do....	288	----------	275	861	327	383
Natural gas (carbon dioxide) [4].	----------	----------	----------	----------	($4, 136)	($4, 400)
Silver, fine........kilograms..	3	1	----------	2	2	----------
Stone for building, etc.: [4]						
Granite.....................	($146, 280)	($37, 168)	($22, 173)	($16, 931)	($55, 096)	($37, 345)
Limestone...................	----------	----------	----------	----------	----------	($3, 055)
Sandstone...................	($60, 072)	($69, 580)	($62, 331)	($51, 376)	($52, 317)	($55, 752)
ORANGE FREE STATE						
Coal.....................tons..	942, 817	932, 463	931, 001	992, 214	1, 041, 463	1, 069, 906
Gems: Diamonds.....carats..	298, 618	279, 212	287, 519	313, 959	323, 609	400, 858
Gold, fine..............grams..	----------	----------	----------	----------	1, 835	----------
Gypsum [1]...................	($6, 670)	($5, 375)	($423)	($267)	($78)	($63)
Silver, fine........kilograms..	----------	----------	----------	----------	2	----------
Stone for building, etc.: [4] Sandstone.....................	($18, 786)	($7, 948)	($9, 226)	($11, 977)	($22, 779)	($43, 955)
TRANSVAAL						
Abrasives:						
Corundum..........tons..	1, 695	1, 662	5, 439	965	1, 832	3, 272
Diatomite..........do....	236	----------	----------	----------	----------	----------
Arsenic, white..........do....	102	33	38	53	17	33
Asbestos:						
Amosite asbestos...do....	(6)	(6)	2, 667	4, 620	6, 122	8, 400
Blue asbestos.......do....	(6)	(6)	28	42	60	----------
Chrysotile asbestos.do....	(6)	(6)	6, 471	11, 044	11, 033	16, 079
Total...............do....	3, 846	6, 920	9, 166	15, 706	17, 215	24, 479
Chromite...............do....	4, 572	13, 756	12, 042	16, 959	31, 756	63, 974
Coal.....................do....	6, 393, 618	6, 980, 454	7, 148, 600	6, 998, 752	7, 178, 805	7, 220, 668
Coal by-products: Tar ....hectoliters..	814	9, 468	9, 310	9, 864	9, 538	10, 171
Cobalt ore..............tons..	----------	----------	----------	----------	----------	3
Coke, metallurgical.....do....	128	25	134	27	----------	----------
Copper:						
Ore treated..........do....	131, 560	156, 918	160, 614	174, 952	176, 347	204, 569
Metal (smelter output) ....kilograms..	6, 405, 598	5, 801, 416	5, 929, 328	6, 709, 503	6, 263, 171	7, 039, 716
Feldspar.................tons..	----------	----------	101	29	30	----------
Fluorspar...............do....	10, 192	4, 883	8, 403	7, 582	5, 582	2, 715
Gems:						
Beryl [4]...................	----------	----------	----------	----------	($15, 533)	($78, 711)
Diamonds..........carats..	851, 661	902, 595	1, 698, 534	3, 097, 831	1, 915, 185	1, 778, 271
Jade [4]...................	($1, 427)	----------	----------	----------	----------	($185)

[1] Only value reported by Provinces.

[2] Average lead content reported as follows: 1924, 70.19 per cent; 1925, 70.97 per cent; 1926, 69.78 per cent; 1927, 76.90 per cent.

[3] Average manganese content reported as 50 per cent in 1927; 1929 content not stated.

[4] Value only reported.

[5] Average tin content reported as follows: 1926, 76 per cent; 1929, 71.14 per cent.

[6] Data not available.

Mineral production of the Union of South Africa, 1924–1929, by Provinces—Contd.

Province and mineral	1924	1925	1926	1927	1928	1929
TRANSVAAL—continued						
Gold, fine..............grams..	297, 813, 280	298, 517, 929	309, 627, 751	314, 843, 711	322, 050, 326	323, 859, 584
Graphite...............tons..	50	47	46	58	51	53
Lead:						
Concentrates [7]......tons..	([6])	1, 768	123	244	53	63
Metal (smelter output) ....kilograms..	4, 609, 382	------------	------------	------------	------------	------------
Magnesite..............tons..	2, 001	1, 823	1, 884	1, 839	1, 481	1, 709
Manganese ore [8]........do....	930	471	835	574	------------	------------
Mica...................do....	735	1, 462	872	1, 454	3, 419	1, 464
Mineral paint ores......do....	------------	------------	------------	------------	20	------------
Platinum metals:						
Osmiridium, fine..grams..	179, 280	170, 758	193, 712	170, 229	176, 388	180, 711
Platinum—						
Crude platinum.do....	------------	------------	360, 241	542, 103	680, 637	1, 458, 847
Concentrates....tons..	------------	------------	160	482	737	286
Total estimated content of platinum metals....grams..	------------	------------	327, 986	608, 695	736, 002	927, 319
Pyrite, iron.............tons..	2, 349	2, 512	2, 448	2, 254	3, 754	4, 116
Silver, fine........kilograms..	434, 495	361, 257	305, 229	314, 683	320, 790	320, 918
Slate [4]......................	($24,634)	($27, 496)	($31, 438)	($41, 834)	($37, 601)	($92, 397)
Soda...................tons..	318	1, 716	1, 680	2, 119	2, 535	2, 555
Stone for building, etc. [4]						
Granite..................	($196, 268)	($186, 325)	($36, 330)	($48, 090)	($37, 572)	($39, 598)
Limestone................	($3, 383)	($5, 162)	($6, 986)	($24, 777)	($29, 402)	($34, 819)
Sandstone................	($97, 405)	($27, 453)	($29, 752)	($30, 391)	($31, 543)	($21, 973)
Talc and soapstone.....tons..	575	60	76	307	541	464
Tin concentrates [9]......do....	1, 786	1, 763	1, 649	1, 735	1, 879	1, 833
Verdite.................do....	------------	------------	105	------------	------------	------------

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[4] Value only reported.

[6] Data not available.

[7] Average lead content reported as follows: 1925, 74.61 per cent; 1926, 80.38 per cent; 1927, 83.95 per cent; 1928, 77.78 per cent; 1929, 81.36 per cent.

[8] Average manganese content reported as follows: 1924, 70.54 per cent; 1925, 45.08 per cent; 1926, 41.46 per cent; 1927, 44.87 per cent.

[9] Average tin content reported as follows: 1924, 66.06 per cent; 1925, 66.09 per cent; 1926, 68.09 per cent; 1927, 67.18 per cent; 1928, 67.54 per cent; 1929, 66.60 per cent.

UNITED KINGDOM (GREAT BRITAIN AND NORTHERN IRELAND)

Mineral production of Great Britain, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Alum clay..............tons..	13, 358	11, 436	8, 393	9, 313	9, 108	9, 494
Arsenic, white, and arsenic soot..................tons..	3, 258	2, 586	1, 693	1, 358	1, 314	968
Barite:						
Ground—						
Bleached........do....	14, 063	1, 908	2, 032	1, 953	589	1, 211
Unbleached.....do....		10, 635	13, 025	13, 467	15, 343	17, 178
Unground...........do....	41, 583	36, 919	28, 405	32, 185	34, 770	39, 622
Total............do....	55, 646	49, 462	43, 462	47, 605	50, 702	58, 011
Briquets, fuel...........do....	1, 208, 610	1, 243, 090	850, 774	1, 502, 053	1, 151, 270	1, 394, 898
Cadmium (exports)[2] ....kilograms..	3, 877	1, 950	7, 930	10, 378	768	2, 357
Calcspar...............tons..	9, 455	13, 013	15, 044	17, 797	16, 565	([3])
Chalk..................do....	4, 473, 221	5, 116, 167	4, 384, 638	5, 857, 720	6, 092, 277	6, 634, 144
Chert and flint:						
For use in pottery..do....	1, 219	1, 409	1, 041	1, 373	1, 534	1, 397
For road making, etc.do....	149, 440	135, 441	120, 034	110, 085	155, 506	139, 378
Total............do....	150, 659	136, 850	121, 075	111, 458	157, 040	140, 775
China stone............do....	55, 581	64, 633	48, 536	64, 633	62, 567	65, 594
Chromite [4]...............do....	1, 060	455	------------	384	------------	------------

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[1] Source of data: Ann. Repts. of Secretary for Mines and Chief Insp. Mines, Mines Dept., London; Mineral Industry of the British Empire and Foreign Countries; Statistical Summary, Imp. Inst., London (annual), except as otherwise noted.

[2] Exports of domestic produce.

[3] Data not available.

[4] Average content of Cr_2O_3 reported as follows: 1924, 25 per cent; 1925, 32 per cent; 1927, 34 per cent.

Mineral production of Great Britain, 1924-1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Clay:						
Fire clay ....tons	2, 212, 865	2, 265, 054	1, 515, 589	2, 450, 230	2, 297, 767	2, 243, 084
Kaolin (china clay) do	819, 306	863, 805	839, 211	883, 183	799, 932	839, 304
Potters' clay, including ball clay ....tons	229, 578	210, 146	187, 488	194, 007	191, 945	209, 495
Other clay, including shale ....tons	11, 041, 467	13, 304, 945	13, 152, 417	14, 843, 997	13, 491, 359	14, 535, 938
Coal:						
Anthracite........do	5, 512, 725	6, 224, 718	2, 922, 825	6, 387, 457	5, 610, 191	6, 466, 179
Bituminous........do	265, 892, 689	240, 854, 492	125, 382, 466	248, 877, 158	235, 673, 164	255, 580, 027
Total........do	271, 405, 414	247, 079, 210	128, 305, 291	255, 264, 615	241, 283, 355	262, 046, 206
Coke:						
Gas-house [5]........do	12, 279, 666	12, 022, 759	11, 784, 401	12, 562, 447	12, 411, 903	12, 610, 467
Metallurgical........do	12, 958, 049	11, 185, 375	4, 790, 420	12, 027, 121	12, 035, 326	13, 637, 421
Coke by-products:						
Ammonium sulphate (25.75 per cent NH_3) ....tons	460, 746	436, 411	328, 684	481, 044	632, 229	926, 901
Benzol........hectoliters	909, 000	778, 000	409, 000	1, 181, 000	1, 272, 000	1, 640, 000
Tar........tons	1, 842, 838	1, 716, 609	1, 377, 536	1, 807, 826	1, 880, 952	1, 983, 499
Copper:						
Concentrates [6]........do	------------	------------	157	274	------------	------------
Precipitate [7]........do	195	150	130	209	106	106
Metal [8] [9]........kilograms	123	97	110	180	69	69
Feldspar........tons	1, 070	------------	------------	------------	------------	------------
Fluorspar........do	50, 286	39, 706	36, 459	40, 362	47, 614	42, 432
Fuller's earth [10]........	(10)	(10)	(10)	(10)	(10)	(10)
Ganister [11]........tons	644, 614	502, 226	343, 237	577, 954	519, 101	557, 954
Gold concentrates........do	------------	------------	------------	------------	163	71
Gold, fine [8]........grams	------------	------------	------------	------------	3, 701	373
Gypsum:						
Raw stone........tons	(3)	(3)	(3)	309, 271	202, 740	216, 502
Dressed, ground, or broken........tons	(3)	(3)	(3)	205, 093	442, 091	765, 064
Total........do	377, 248	420, 952	472, 567	514, 364	644, 831	981, 566
Iron:						
Ore [12]........do	11, 227, 951	10, 305, 671	4, 160, 101	11, 386, 467	11, 443, 083	13, 427, 043
Pig iron [13]........do	7, 424, 684	6, 362, 200	2, 497, 700	7, 410, 000	6, 717, 400	7, 711, 100
Iron oxide (bog ore)........do	3, 251	4, 868	3, 641	3, 352	3, 699	10, 593
Lead:						
Concentrates [14]........do	14, 523	15, 828	19, 382	20, 756	19, 072	23, 633
Metal [8] [15]........kilograms	11, 037, 351	12, 029 016	14, 730, 693	15, 774, 176	14, 314, 112	17, 961, 732
Manganese ore [16]........tons	2, 496	842	130	1, 048	239	------------
Manganiferous iron ore [17] ....do	------------	------------	------------	486	------------	------------
Mineral paint ores (ocher, umber, etc.)........tons	10, 637	11, 404	10, 367	10, 632	10, 673	9, 493
Natural gas [18]........	(18)	(18)	(18)	(18)	(18)	(18)
Oil shale........tons	2, 902, 960	2, 504, 390	1, 991, 250	2, 080, 122	2, 070, 826	2, 056, 088
Petroleum, crude........do	317	389	283	229	79	------------
Pyrite:						
Arsenical pyrite........do	304	(10)	------------	81	------------	20
Iron pyrite........do	5, 658	5, 373	4, 307	4, 968	4, 440	4, 441

[3] Data not available.

[5] Includes coke breeze.

[6] Average copper content reported as follows: 1926, 17 per cent; 1927, 16 per cent.

[7] Average copper content reported as follows: 1924, 63 per cent; 1925 and 1926, 64 per cent; 1927 and 1928, 65 per cent; 1929, 63 per cent.

[8] Approximate quantity of metal obtainable by smelting from ores raised in Great Britain.

[9] The approximate smelter output of copper is reported by the Imp. Inst., London, as follows: 1924, 21,500 tons; 1925, 20,700 tons; 1926, 17,900 tons; 1927, 22,600 tons; 1928, 21,400 tons; 1929, 23,700 tons.

[10] Production reported, but figures not available for publication.

[11] Includes siliceous rock and sand.

[12] Exclusive of bog ore, which is used mainly for purification of gas.

[13] Includes ferro-alloys.

[14] Average lead content reported as follows: 1924 to 1927, inclusive, 80 per cent; 1928, 79 per cent; 1929, 80 per cent.

[15] Output of pig lead reported by the London Metal Exchange as follows: 1924, 5,387 tons; 1925, 4,811 tons; 1926, 4,334 tons; 1927, 6,132 tons; 1928, 8,638 tons; 1929, 10,839 tons.

[16] Average manganese content reported as follows: 1924, 30 per cent; 1925, 31 per cent; 1926 and 1928, 34 per cent; 1927, 32 per cent.

[17] Average manganese content reported as 18 per cent.

[18] Small quantities of natural gas are obtained at Hardstoft in Derbyshire and Heathfield in Sussex, England, but no figures of output are reported.

Mineral production of Great Britain, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Salt:						
Brine salt—						
For salt making..tons..	891, 528	805, 952	679, 322	839, 259	767, 922	803, 177
Salt in brine used for other purposes ....tons..	1, 125, 386	1, 106, 109	1, 029, 542	1, 145, 991	1, 170, 653	1, 158, 847
Total.......do....	2, 016, 914	1, 912, 061	1, 708, 864	1, 985, 250	1, 938, 575	1, 962, 024
Rock salt...........do....	43, 076	35, 281	35, 152	22, 809	24, 254	28, 786
Sand:						
Glass sand..........do....	(3)	79, 654	61, 507	85, 072	77, 465	88, 458
Molding and pig-bed sand ....tons..	659, 254	690, 466	529, 394	706, 374	676, 917	692, 753
Other sand, including gravel..............tons..	2, 969, 391	3, 722, 365	4, 494, 716	4, 987, 775	5, 311, 637	6, 274, 299
Silver, fine........kilograms..	1, 048	1, 009	1, 286	1, 453	1, 019	1, 119
Slate....................tons..	292, 323	310, 670	304, 941	303, 058	305, 070	305, 657
Soapstone...............do....	------------	------------	------------	------------	164	29
Stone:						
Dolomite, refractory..do....	406, 000	490, 355	380, 000	589, 626	588, 475	615, 419
Felsite................do....	36, 484	36, 707	------------	------------	------------	------------
Igneous rocks.......do....	7, 551, 991	8, 317, 239	8, 378, 073	8, 603, 714	8, 616, 100	8, 884, 735
Limestone—						
For building, paving, etc...............tons..	332, 000	458, 000	500, 000	515, 000	513, 000	374, 000
For chemical and allied uses.......tons..	1, 085, 000	914, 000	703, 000	937, 000	925, 000	896, 000
For flux...........do....	3, 330, 000	2, 828, 000	1, 211, 000	3, 071, 000	2, 909, 000	3, 334, 000
For glass making ....tons..	(3)	(3)	(3)	34, 000	35, 000	39, 000
For lime and cement ....tons..	3, 489, 000	3, 927, 000	3, 585, 000	4, 063, 000	3, 694, 000	3, 868, 000
For road making ....tons..	3, 955, 000	4, 525, 000	4, 603, 000	5, 108, 000	5, 326, 000	5, 404, 000
For other uses..do....	422, 000	128, 000	214, 000	325, 000	344, 000	[19] 699, 000
Total..........do....	12, 613, 000	12, 780, 000	10, 816, 000	14, 053, 000	13, 746, 000	[19] 14, 614, 000
Sandstone...........do....	2, 572, 554	2, 935, 105	3, 032, 080	3, 181, 665	3, 209, 579	3, 100, 707
Strontium, sulphate of..do....	1, 473	1, 087	833	3, 140	7, 240	5, 415
Tin:						
Concentrates [20].....do....	3, 604	4, 097	3, 940	4, 390	4, 922	5, 731
Metal [8] [21]......kilograms..	2, 017, 875	2, 376, 541	2, 364, 348	2, 634, 618	2, 805, 314	3, 323, 499
Tungsten concentrates [22] tons..	2	1	19	12	98	27
Uranium concentrates [23] do....	20	116	------------	------------	(10)	(10)
Zinc:						
Concentrates [24].....do....	2, 354	1, 629	1, 975	2, 958	1, 578	1, 840
Metal [8] [25]......kilograms..	826, 049	572, 036	662, 465	991, 665	565, 940	674, 657

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[3] Data not available.

[8] Approximate quantity of metal obtainable by smelting from ores raised in Great Britain.

[10] Production reported, but figures not available for publication.

[19] Includes calcspar.

[20] Average tin content reported as follows: 1924, 56 per cent; 1925, 58 per cent; 1926 and 1927, 60 per cent; 1928, 57 per cent; 1929, 58 per cent.

[21] Approximate smelter output of tin reported as follows: 1924, 36,600 tons; 1925, 39,600 tons; 1926, 42,700 tons; 1927, 43,700 tons; 1928, 49,800 tons; 1929, 57,900 tons.

[22] Average content of WO_3 reported as follows: 1924, 68 per cent; 1925, 60 per cent; 1926, 63 per cent; 1927, 61 per cent; 1928 and 1929, 59 per cent.

[23] Average content of U_3O_8 reported as follows: 1924, 3 per cent; 1925, 2 per cent.

[24] Average zinc content reported as follows: 1924, 45 per cent; 1925 and 1928, 46 per cent; 1926 and 1927, 43 per cent; 1929, 47 per cent.

[25] The production of slab zinc is reported as follows: 1924, 39,098 tons; 1925, 38,761 tons; 1926, 18,278 tons; 1927, 42, 541tons; 1928, 56,284 tons; 1929, 59,234 tons. 1924–1927, figures of American Bureau of Metal Statistics, 1928 and 1929, figures of London Metal Exchange.

Mineral production of Great Britain, 1924–1929, by States

State and mineral	1924	1925	1926	1927	1928	1929
ENGLAND						
Alum clay....tons	1, 736	------	------	------	------	------
Arsenic, white, and arsenic soot....tons	3, 258	2, 586	1, 693	1, 358	1, 314	968
Barite....do	41, 203	27, 821	20, 839	22, 212	29, 561	35, 674
Briquets, fuel [1]....do	23, 207	20, 757	28, 213	15, 918	12, 661	16, 009
Calcspar....do	9, 111	11, 424	13, 478	15, 204	14, 072	(7)
Chalk....do	4, 472, 921	5, 115, 723	4, 383, 958	5, 857, 043	6, 091, 920	6, 633, 756
Chert and flint....do	146, 579	131, 185	116, 206	106, 341	153, 047	137, 879
China stone....do	55, 581	64, 633	48, 536	64, 633	62, 567	65, 594
Clay:						
Fire clay....do	1, 529, 163	1, 594, 022	1, 137, 188	1, 706, 449	1, 558, 161	1, 541, 884
Kaolin....do	819, 306	863, 805	839, 211	883, 183	799, 932	839, 304
Potters' clay, including ball clay....tons	229. 578	210, 146	187, 488	194, 007	191, 945	209, 495
Other clay, including shale....tons	10, 060, 362	12, 182, 037	12, 249, 752	13, 621, 768	12, 469, 417	13 562, 822
Coal:						
Anthracite [1]....do	(1)	(1)	(1)	(1)	(1)	(1)
Bituminous....do	193, 807, 042	165, 025, 938	88, 895, 687	169, 611, 588	161, 016, 734	174, 887, 875
Coke:						
Gas-house....do	10, 888, 034	10, 642, 092	[1] 10,314, 294	[1] 11,087, 042	[1] 11,079, 260	[1] 11, 199, 395
Metallurgical [3]....do	12, 456, 924	10, 762, 816	4, 572, 097	11, 495, 393	11, 511, 753	13, 106, 818
Copper:						
Concentrates....do	------	------	157	274	------	------
Precipitate....do	135	88	73	100	58	39
Feldspar....do	1, 070	------	------	------	------	------
Fluorspar....do	50, 286	39, 706	36, 459	40, 362	47, 614	42. 432
Fuller's earth [2]....	(2)	(2)	(2)	(2)	(2)	(2)
Ganister....tons	451, 097	334, 179	241, 743	395, 213	351, 484	381, 172
Gypsum....do	377, 248	420, 952	472, 567	514, 364	644, 831	981, 566
Iron:						
Ore....do	11, 078, 892	10, 166, 714	4, 112, 188	11, 231, 779	11, 245, 793	13, 187, 027
Pig iron [3]....do	6, 743, 763	5, 925, 300	2, 306, 200	6, 707, 000	(4)	(4)
Iron oxide (bog ore)....do	3, 251	4, 868	3, 641	3, 352	3, 699	10, 593
Lead concentrates....do	10, 419	11, 888	14, 626	15, 759	14, 668	19, 353
Manganiferous iron ore....do	------	------	------	486	------	------
Mineral paint ores....do	10, 236	10, 800	9, 704	9, 878	9, 843	8, 737
Natural gas [5]....	(5)	(5)	(5)	(5)	(5)	(5)
Petroleum....tons	317	389	283	229	79	------
Pyrite:						
Arsenical pyrite....do	304	(2)	------	81	------	20
Iron pyrite....do	5, 658	5, 373	4, 307	4, 968	4, 440	4, 441
Salt:						
Brine salt [6]....do	2, 016, 914	1, 912, 061	1, 708, 864	1, 985, 250	1, 938, 575	1, 962, 024
Rock salt....do	43, 076	35, 281	35, 152	22, 809	24, 254	28, 786
Sand:						
Molding and pig bed sand....tons	590, 491	617, 204	469, 190	622, 692	598, 128	611, 678
Other sand, including gravel....tons	2, 556, 730	3, 381, 167	4, 067, 887	4, 458, 558	4, 737, 468	5, 674, 430
Slate....do	29, 307	30, 224	30, 681	28, 964	32, 437	30, 124
Stone:						
Felsite....do	561	704	------	------	------	------
Igneous rocks....do	3, 726, 584	3, 991, 862	3, 824, 790	3, 834, 095	3, 815, 997	3, 924, 686
Limestone, including dolomite....tons	10, 059, 597	10, 328, 872	8, 657, 164	11, 519, 784	11, 292, 669	[7] 11, 978, 185
Sandstone....do	2, 024, 835	2, 335, 951	2, 525, 203	2, 642, 646	2, 736, 463	2, 703, 569
Strontium, sulphate of....do	1, 473	1, 089	833	3, 140	7, 240	5, 415
Tin:						
Concentrates....do	3, 604	4, 097	3, 940	4, 390	4, 922	5, 731
Metal [8]....kilograms	2, 017, 875	2, 376, 541	2, 364, 348	2, 634, 618	2, 805, 314	3, 323, 499
Tungsten concentrates....tons	2	1	19	12	98	27
Uranium concentrates....do	20	116	------	------	(2)	(2)
Zinc concentrates....do	1, 125	920	1, 228	1, 582	895	151
SCOTLAND						
Alum clay....tons	11, 622	11, 436	8, 393	9, 313	9, 108	9, 494
Barite....do	13, 563	20, 462	21, 697	24, 759	21, 141	21, 122
Briquets, fuel....do	57, 813	59, 575	79, 525	45, 821	47, 048	53, 503
Chromite....do	1, 060	455	------	384	------	------
Clay:						
Fire clay....do	588, 566	571, 343	313, 819	655, 051	614, 354	580, 095
Other clay, including shale....tons	458, 689	491, 380	335, 170	537, 187	492, 805	431, 799

[1] Output of Monmouthshire, England, included under Wales.
[2] Production reported, but figures not available for publication.
[3] Output of Wales included under England.
[4] Data by States not available.
[5] See footnote 18 under summary table for Great Britain.
[6] Output of the Isle of Man included under England.
[7] Includes calcspar.
[8] Approximate quantity of metal obtainable by smelting from ores raised in Great Britain.

Mineral production of Great Britain, 1924–1929, by States—Continued

State and mineral	1924	1925	1926	1927	1928	1929
SCOTLAND—continued						
Coal:						
Anthracite..........tons..	461, 510	568, 831	354, 982	547, 393	676, 725	780, 718
Bituminous..........do....	36, 309, 625	32, 989, 805	16, 667, 670	34, 605, 594	32, 201, 582	33, 943, 669
Coke:						
Gas-house..........do....	1, 103, 207	1, 090, 870	1, 148, 939	1, 167, 810	1, 031, 597	1, 099, 422
Metallurgical..........do....	501, 125	422, 559	218, 323	531, 728	523, 573	530, 603
Ganister..........do....	46, 159	42, 925	23, 208	48, 700	47, 673	52, 193
Iron:						
Ore..........do....	56, 503	39, 435	13, 386	28, 800	14, 621	26, 687
Pig iron..........do....	680, 921	436, 900	191, 500	703, 000	(4)	(4)
Lead concentrates..........do....	3, 884	3, 519	4, 393	4, 422	4, 196	3, 891
Oil shale..........do....	2, 902, 960	2, 504, 390	1, 991, 250	2, 080, 122	2, 070, 826	2, 056, 088
Sand:						
Molding and pig bed sand..........tons..	68, 763	73, 262	60, 204	83, 682	78, 789	81, 075
Other sand, including gravel..........tons..	382, 623	394, 254	465, 063	561, 332	592, 004	574, 514
Slate..........do....	16, 227	16, 985	13, 283	13, 663	13, 844	22, 729
Soapstone..........do....	----------	----------	----------	----------	164	29
Stone:						
Felsite..........do....	35, 923	36, 003	----------	----------	----------	----------
Igneous rocks..........do....	3, 726, 584	3, 991, 862	3, 824, 790	3, 834, 095	3, 815, 997	3, 924, 686
Limestone, including dolomite..........tons..	324, 952	245, 353	225, 779	271, 955	230, 121	287, 890
Sandstone..........do....	281, 288	307, 697	290, 761	255, 755	250, 569	195, 313
Zinc concentrates..........do....	4	----------	----------	197	282	644
WALES						
Barite..........tons..	880	1, 179	926	634	----------	1, 215
Briquets, fuel [1]..........do....	1, 127, 590	1, 162, 758	743, 036	1, 440, 314	1, 091, 561	1, 325, 386
Calcspar..........do....	344	1, 589	1, 566	2, 593	2, 474	(2)
Chalk..........do....	300	444	680	677	357	388
Chert and flint..........do....	4, 080	5, 665	4, 869	5, 117	3, 993	2, 896
Clay:						
Fire clay..........do....	95, 136	99, 689	64, 582	88, 730	125, 252	121, 105
Other clay, including shale..........tons..	510, 615	617, 393	561, 143	670, 713	514, 919	525, 031
Coal:						
Anthracite [1]..........do....	5, 051, 215	5, 655, 887	2, 567, 843	5, 840, 064	4, 933, 466	5, 685, 461
Bituminous..........do....	35, 776, 022	42, 838, 749	19, 819, 109	44, 659, 976	42, 454, 848	46, 748, 483
Coke:						
Gas-house..........do....	274, 790	273, 637	307, 231	295, 295	286, 296	295, 664
Metallurgical [3]..........do....	(3)	(3)	(3)	(3)	(3)	(3)
Copper precipitate..........do....	60	62	57	109	48	67
Ganister..........do....	147, 358	125, 080	78, 286	134, 041	119, 944	124, 589
Gold concentrates..........do....	----------	----------	----------	----------	163	71
Iron:						
Ore..........do....	92, 556	99, 522	34, 527	125, 888	182, 669	213, 329
Pig iron [3]..........do....	(3)	(3)	(3)	(3)	(3)	(3)
Lead concentrates..........do....	99	298	239	365	125	356
Manganese ore..........do....	2, 496	842	130	1, 048	239	----------
Mineral paint ores..........do....	401	604	663	754	830	756
Sand and gravel..........do....	29, 907	26, 510	23, 109	52, 361	59, 507	113, 742
Slate..........do....	240, 656	249, 392	256, 002	258, 010	251, 324	243, 636
Stone:						
Igneous rocks..........do....	1, 408, 629	1, 531, 338	1, 472, 747	1, 529, 708	1, 551, 013	1, 629, 586
Limestone, including dolomite..........tons..	2, 618, 576	2, 680, 798	2, 295, 656	2, 833, 058	2, 799, 503	2, 952, 077
Sandstone..........do....	262, 958	289, 521	215, 461	282, 080	220, 568	199, 366
Zinc concentrates..........do....	182	3	139	529	118	908
ISLE OF MAN						
Calcspar..........tons..	----------	----------	----------	----------	19	(2)
Clay and shale..........do....	11, 801	14, 135	6, 352	14, 329	14, 218	16, 286
Coke, gas-house..........do....	13, 635	16, 160	13, 937	12, 300	14, 750	15, 986
Ganister..........do....	----------	42	----------	----------	----------	----------
Lead concentrates..........do....	121	122	124	210	83	33
Salt, brine [6]..........do....	(6)	(6)	(6)	(6)	(6)	(6)
Sand and gravel..........do....	131	88	164	596	123	71
Slate..........do....	6, 133	14, 069	4, 975	2, 421	7, 465	9, 168
Stone:						
Igneous rocks..........do....	106, 170	101, 125	90, 230	112, 602	107, 911	121, 421
Limestone, including dolomite..........tons..	16, 002	15, 355	17, 031	17, 990	12, 619	[7] 11, 611
Sandstone..........do....	3, 473	1, 936	655	1, 184	1, 979	2, 459
Zinc concentrates..........do....	1, 043	706	608	650	283	137

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[1] Output of Monmouthshire, England, included under Wales.
[2] Production reported, but figures not available for publication.
[3] Output of Wales included under England.
[4] Data by States not available.
[6] Output of the Isle of Man included under England.
[7] Includes calcspar.

Mineral production of Northern Ireland, 1924–1929, in tons [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Diatomite	2,480	3,397	3,023	3,427	4,312	4,275
Bauxite	5,241	5,121	(2)	5,394	2,322	2,359
Chalk	189,292	193,298	143,452	232,318	197,276	258,565
Clay:						
Fire clay	3,000	5,091	5,000	5,000	4,800	6,600
Other clay	125,812	158,784	127,070	150,005	176,510	191,815
Coal (lignite)	(2)	(2)	(2)	510	650	327
Flint	1,228	911	859	937	615	810
Gypsum	421	231	90	113	17	1,453
Iron ore	6,941	3,498	(2)	5,303	819	700
Salt:						
Brine salt	7,370	7,230	4,960	(2)	7,130	7,092
Rock salt	11,235	10,052	6,191	7,262	7,598	7,954
Sand and gravel	30,957	38,396	25,790	29,849	44,444	51,578
Stone:						
Igneous rocks—						
Granite	(2)	142,442	118,652	106,293	103,692	95,391
Other igneous rocks	296,322	373,400	334,623	325,176	374,501	441,989
Limestone	31,221	65,949	58,692	32,678	52,284	60,436
Sandstone, including grit and conglomerate	162,486	154,411	142,223	159,169	210,381	191,107

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[1] Source of data: Annual Report on the Mining and Quarrying Industries in Northern Ireland: Ministry of Commerce, Belfast (annual): Mineral Industry of the British Empire and Foreign Countries: Statistical Summary, Imp. Inst., London (annual).

[2] Data not available.

UNITED STATES OF AMERICA

Mineral production of the United States of America, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives (sales):						
Diatomite tons	57,300	66,251	79,039	(2)	(2)	(2)
Emery do	1,991	698	350	459	1,217	838
Garnet do	7,521	7,647	5,803	6,295	6,003	5,408
Grinding pebbles and tube-mill lining tons	2,297	3,475	5,642	3,032	5,704	4,200
Grindstones and pulpstones tons	34,631	33,874	34,780	28,967	30,153	25,162
Millstones [3]	($30,125)	($22,490)	($45,937)	($35,438)	($42,886)	($31,407)
Oilstones and scythe stones tons	958	880	1,524	951	867	760
Pumice and pumicite tons	39,599	36,632	48,885	48,351	52,099	60,793
Tripoli and rottenstone tons	25,833	26,660	28,457	33,676	30,883	34,483
Aluminum, primary metal kilograms	68,000,000	64,000,000	66,000,000	73,000,000	95,000,000	102,000,000
Antimony ore [4] tons	103	112	90	------------	78	------------
Arsenic, white (sales):						
Crude tons	1,980	977	751	1,397	3,313	4,285
Refined do	11,131	10,197	9,958	9,090	7,362	8,911
	13,111	11,174	10,709	10,487	10,675	13,196
Asbestos (sales):						
Amphibole do	115	1,057	(2)	(2)	(2)	1,063
Chrysotile do	157	84	(2)	(2)	(2)	1,799
	272	1,141	1,232	2,704	2,031	2,862
Asphalt (sales):						
Asphalt rock do	477,023	494,467	610,305	722,206	689,908	679,070
Native asphalt and related bitumens tons	33,145	36,097	38,492	38,954	42,967	50,328
	510,168	530,564	648,797	761,160	732,874	729,398

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[1] Source of data: United States, Bureau of Mines, Mineral Resources of the United States. Washington (annual).

[2] Production reported, but figures not available for publication.

[3] Figures for quantity not available.

[4] Antimony content reported as follows: 1924–25, 30 tons; 1926, 39 tons; 1928, 38 tons.

Mineral production of the United States of America, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Barite, crude.......tons..	178, 108	206, 894	215, 795	230, 664	244, 525	251, 533
Bauxite.............do....	353, 148	321, 620	398, 546	326, 091	381, 452	371, 648
Bismuth, metallic [5] ....kilograms..	(2)	(2)	(2)	(2)	(2)	(2)
Borates [6]...........tons..	105, 333	103, 146	105, 206	98, 955	118, 841	154, 103
Briquets, fuel......do....	526, 591	761, 460	902, 945	880, 389	859, 483	1, 099, 879
Bromine.....kilograms..	922, 513	710, 376	565, 064	796, 645	981, 569	2, 909, 607
Cadmium:						
Cadmium compounds [7] ......kilograms..	(2)	51, 256	75, 568	103, 872	108, 816	196, 541
Metallic cadmium ....kilograms..	58, 662	228, 076	367, 602	487, 452	850, 888	1, 125, 550
Calcium-magnesium chloride (sales) [8].tons..	53, 334	61, 570	74, 697	86, 836	92, 614	103, 636
Carbon black [9]......kilograms..	84, 763, 286	80, 474, 748	81, 907, 548	90, 005, 410	112, 848, 656	166, 214, 427
Cement (shipments):						
Portland cement ....tons..	24, 908, 380	26, 826, 667	27, 660, 976	29, 311, 495	29, 989, 192	28, 971, 008
Other cements..do..	241, 918	298, 756	346, 532	368, 102	377, 537	368, 239
	25, 150, 298	27, 125, 423	28, 007, 508	29, 679, 597	30, 366, 729	29, 339, 247
Chats.................do..	2, 348, 576	1, 881, 010	2, 111, 734	2, 400, 054	2, 057, 000	2, 644, 100
Chromite (shipments) ....tons..	293	110	143	204	671	273
Clay (sales): [10]						
Fire clay.......tons..	2, 216, 885	2, 328, 671	2, 557, 654	2, 449, 169	2, 526, 640	2, 883, 748
Kaolin and paper clay..........tons..	296, 295	333, 224	392, 097	412, 082	450, 090	470, 073
Other clay.....do....	835, 330	994, 421	649, 212	630, 644	675, 878	589, 709
Coal:						
Anthracite (Pennsylvania)........tons..	79, 765, 491	56, 079, 281	76, 599, 968	72, 661, 094	683, 354, 261	66, 975, 462
Bituminous and lignite..........tons..	438, 790, 754	471, 781, 446	520, 147, 061	469, 704, 558	454, 265, 822	485, 330, 952
	518, 556, 245	527, 860, 727	596, 747, 029	542, 365, 652	522, 620, 083	552, 306, 414
Coke:						
Gas-house [11]..do....	(12)	2, 637, 189	(12)	2, 581, 099	2, 500, 000	(12)
Metallurgical.do....	40, 160, 500	46, 508, 345	51, 587, 278	46, 349, 770	47, 904, 391	54, 325, 427
Coke-oven by-products: [13]						
Ammonium sulphate [14].kilograms.	494, 070, 715	579, 705, 083	626, 839, 775	650, 865, 522	724, 733, 872	776, 740, 142
Benzol—						
Crude and refined ...hectoliters..	686, 471	846, 055	850, 133	833, 067	812, 020	944, 233
Motor benzol ...hectoliters..	2, 792, 394	3, 083, 907	3, 407, 933	3, 293, 063	3, 900, 857	4, 009. 566
Tar............do....	15, 976, 915	18, 201, 724	20, 042, 817	20, 700, 436	23, 917, 422	25, 772, 977
Copper:						
Mine production ....kilograms..	728, 540, 391	761, 177, 429	782, 567, 910	748, 405, 071	820, 905, 779	904, 962, 125
Smelter production [15].kilograms..	741, 279, 091	759, 704, 232	789, 075, 186	763, 864, 149	828, 210, 159	908, 478, 689
Feldspar, crude..tons...	208, 059	188, 687	213, 359	205, 747	214, 195	200, 872
Fluorspar (shipments) ....tons..	113, 378	103, 118	116, 715	102, 099	127, 450	132, 847
Fuller's earth......do....	161, 473	187, 400	212, 418	239, 929	260, 372	286, 653
Gold [16]..........grams..	78, 657, 593	75, 021, 192	72, 627, 934	68, 338, 236	69, 461, 880	68, 688, 492

[2] Production reported, but figures not available for publication.

[5] Obtained as a by-product in refining lead and tin bullion, part of which is from ores of foreign origin.

[6] Colemanite and naturally occurring sodium borates.

[7] Estimated cadmium content.

[8] From natural brines.

[9] Produced from natural gas.

[10] Value of clay products (brick, tile, and pottery) produced in the United States, 1924–1929, is reported as follows: 1924, $415,779,378; 1925, $423,446,917; 1926, $430,428,494; 1927, $403,935,547; 1928, $373,550,882; 1929, $373,409,391.

[11] Sales reported as follows: 1924, 1,300,000 tons (estimated); 1925, 1,241,661 tons; 1926, 1,300,000 tons (estimated); 1927, 1,346,498 tons; 1928, 1,320,000 tons (estimated); 1929, 1,300,000 tons (estimated).

[12] Data not available.

[13] Total sales value of by-products other than those listed reported as follows: 1924, $52,197,057; 1925, $64,364,463; 1926, $70,307,004; 1927, $74,974,299; 1928, $85,376,277; 1929, $96,777,856.

[14] Sulphate equivalent of all forms.

[15] Smelter production from domestic ores. The smelter output from both domestic and foreign materi exclusive of scrap, is reported as follows: 1927, 843,849,770 kilos; 1928, 911,443,808 kilos; 1929, 998,789,350 kil Similar data not available for earlier years.

[16] Includes output of the Philippine Islands.

Mineral production of the United States of America, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Graphite:						
Amorphous...tons..	3, 693	3, 208	2, 699	2, 354	2, 716	3, 225
Crystalline...do...	817	1, 024	2, 263	2, 370	2, 374	2, 634
	4, 510	4, 232	4, 962	4, 724	5, 090	5, 859
Gypsum, crude...do...	4, 574, 572	5, 151, 242	5, 112, 359	4, 850, 590	4, 628, 659	4, 550, 535
Iron:						
Ore (mined)[17]..do....	55, 138, 411	62, 901, 620	68, 708, 349	62, 732, 045	63, 195, 351	74, 199, 815
Pig iron[18]....do...	31, 909, 853	37, 289, 610	40, 004, 661	37, 152, 524	38, 768, 113	43, 297, 937
Lead:						
Mine production[19] ....kilograms..	540, 740, 968	620, 909, 372	620, 435, 824	603, 718, 311	[20] 568, 910, 659	[20] 587, 848, 104
Antimonial lead ......kilograms..	18, 857, 551	17, 841, 509	20, 433, 322	22, 087, 111	29, 989, 556	23, 286, 403
Refined lead, primary—						
From domestic ore and base bullion ...kilograms..	513, 833, 102	594, 131, 233	617, 503, 818	606, 286, 538	568, 077, 930	610, 076, 736
From foreign ore ...kilograms..	42, 079, 545	42, 659, 232	43, 735, 148	29, 364, 509	24, 160, 018	26, 920, 566
From foreign base bullion ...kilograms..	70, 488, 793	58, 988, 472	63, 544, 330	86, 945, 038	116, 334, 042	65, 734, 263
	626, 401, 440	695, 778, 937	724, 783, 296	722, 596, 085	708, 571, 990	702, 731, 565
Lime (sales)......tons..	3, 694, 037	4, 155, 631	4, 137, 102	4, 005, 138	4, 044, 582	3, 873, 448
Lithium minerals..do...	2, 718	2, 849	3, 357	3, 786	4, 173	(2)
Magnesite, crude..do...	108, 952	109, 460	121, 109	110, 213	115, 393	170, 241
Magnesium, new ingots[21].....kilograms..	(12)	(12)	(12)	(12)	236, 354	603, 125
Magnesium salts, natural.........kilograms..	(2)	38, 627, 000	34, 727, 000	31, 644, 000	32, 163, 978	41, 016, 039
Manganese ore (shipments)[22] [23]......tons..	57, 422	99, 902	47, 000	45, 459	47, 612	61, 348
Manganiferous ore (shipments)[24]...tons..	887, 516	1, 443, 319	1, 218, 980	1, 481, 826	1, 194, 857	1, 207, 330
Marls:						
Calcareous (sales) ....tons..	65, 961	62, 296	49, 949	48, 046	55, 369	35, 371
Greensand....do....	12, 750	11, 547	11, 504	10, 805	11, 782	12, 035
Mercury, metallic ....kilograms..	343, 074	312, 083	259, 960	383, 614	616, 030	816, 386
Mica (sales):						
Scrap mica....tons..	4, 272	8, 795	6, 389	5, 697	7, 040	5, 673
Sheet mica....do....	662	814	985	686	763	923
	4, 934	9, 609	7, 374	6, 383	7, 803	6, 596
Mineral paints:						
Natural pigments[25] ....tons..	(25)	(25)	(25)	(25)	(25)	(25)
Zinc and lead pigments......tons..	157, 721	180, 701	167, 183	174, 045	183, 580	185, 585
Molybdenum (sales)[26] ....kilograms..	134, 795	523, 466	649, 464	1, 036, 941	1, 510, 098	1, 771, 109
Monazite (shipments) ....kilograms...	....	[27] 907	....	....	....	....

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[2] Production reported, but figures not available for publication.

[12] Data not available.

[17] Exclusive of ore containing 5 per cent or more of manganese.

[18] Includes ferro-alloys.

[19] Recoverable content of ores.

[20] Exclusive of output from Virginia, figures for which are not available for publication.

[21] Not reported separately prior to 1928. Production of domestic metallic magnesium, including ingots, castings, alloys, ribbon, powder, etc., reported as follows, 1924–1927: 1924, 58,000 kilos; 1925, 111,000 kilos, 1926, 146,350 kilos; 1927, 166,200 kilos.

[22] Ore containing 35 per cent or more of manganese, exclusive of fluxing ore. Shipments of fluxing ore in 1924 reported as 1,862 tons; none reported in 1925–1929, inclusive.

[23] Figures cover continental United States only. In addition, the following quantities of manganese ore were exported from Puerto Rico during the period under review: 1924, 4,698 tons; 1925, 4,260 tons; 1926, 1,440 tons; 1927, 1,650 tons; 1928, 1,547 tons; 1929, 2,353 tons.

[24] Ore containing 5 to 35 per cent of manganese, exclusive of fluxing ore, shipments of which are reported as follows: 1924, 25,373 tons; 1925, 27,976 tons; 1926, 17,991 tons; 1927, 3,241 tons; 1928, 1,676 tons; 1929, none.

[25] Mineral paint ores of various kinds are produced in the United States; but no figures of output are available for the period under review.

[26] Molybdenum content of domestic ores and concentrates sold.

[27] Shipments from Florida, estimated to contain 6 per cent of thoria.

Mineral production of the United States of America, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Natural gas ------M cubic meters--	32, 324, 468	33, 656, 784	37, 180, 780	40, 930, 208	44, 405, 017	54, 303, 343
Natural gasoline ------------hectoliters--	35, 349, 739	42, 678, 483	51, 597, 482	62, 122, 749	68, 667, 209	84, 552, 507
Nickel [28]------kilograms--	173, 271	246, 753	293, 019	780, 175	473, 548	308, 441
Oil shale-----------tons--	[29] 21, 200	(2)	5, 500	7, 600	1, 928	1, 767
Peat---------------do----	50, 320	65, 712	56, 187	(12)	(12)	(12)
Petroleum, crude ------------hectoliters--	1, 135, 050, 000	1, 214, 229, 000	1, 225, 566, 000	1, 432, 651, 000	1, 433, 199, 000	1, 601, 482, 000
Phosphate rock---tons--	2, 913, 817	3, 537, 702	3, 261, 496	3, 221, 589	3, 557, 604	3, 821, 217
Platinum metals, primary:						
Crude platinum, from placers ----------grams--	10, 420	10, 668	8, 896	4, 759	16, 423	24, 789
Recovered in U. S. refineries—						
Iridium-grams--	21, 150	8, 802	7, 278	7, 962	51, 570	9, 393
Palladium --------grams--	188, 643	228, 859	200, 213	120, 650	160, 121	164, 693
Platinum-do----	1, 798, 621	1, 284, 574	2, 368, 654	1, 279, 006	1, 599, 559	1, 298, 881
Osmiridium --------grams--	39, 221	20, 155	65, 722	19, 626	14, 245	11, 322
Other platinum metals-grams--	5, 412	1, 680	1, 337	5, 070	10, 824	7, 962
Potassium salts, crude ------------------tons--	39, 675	46, 779	42, 024	69, 689	94, 464	97, 812
Equivalent in K_2O --------------tons--	20, 777	23, 086	21, 197	39, 471	54, 349	55, 873
Pyrites------------do----	162, 667	172, 811	169, 232	219, 249	[30] 317, 836	[30] 338, 817
Salt:						
Rock salt------do----	1, 873, 061	2, 125, 196	1, 937, 482	1, 944, 867	2, 011, 926	1, 916, 880
Other salt-----do----	4, 298, 589	4, 585, 668	4, 749, 886	4, 921, 297	5, 313, 281	5, 833, 666
	6, 171, 650	6, 710, 864	6, 687, 368	6, 866, 164	7, 325, 207	7, 750, 546
Sand and gravel:						
Sand—						
Glass sand ----------tons--	1, 968, 489	2, 118, 194	2, 063, 125	1, 970, 116	2, 096, 337	2, 013, 647
Other sand ----------tons--	66, 588, 927	76, 971, 775	81, 501, 106	82, 931, 353	86, 569, 365	88, 026, 739
Gravel---------do----	73, 171, 373	76, 946, 328	82, 541, 168	94, 225, 094	101, 051, 824	111, 872, 395
Sand-lime brick ------------thousands--	283, 417	315, 595	330, 586	319, 618	313, 553	269, 584
Selenium [31]--kilograms--	69, 745	88, 000	114, 446	129, 050	164, 516	156, 166
Silica (quartz) crude and ground-----------tons--	21, 556	23, 082	25, 168	20, 089	20, 138	19, 034
Silver [16]------kilograms--	2, 034, 391	2, 057, 664	1, 950, 771	1, 879, 721	1, 818, 387	1, 907, 510
Slate (sales):						
Roofing slate--tons--	143, 715	150, 592	142, 835	160, 154	160, 852	161, 932
Other slate---do----	516, 439	506, 751	508, 520	467, 651	425, 513	445, 942
	660, 154	657, 343	651, 355	627, 805	586, 365	607, 874
Sodium salts, natural (shipments) [32]---tons--	55, 420	50, 666	69, 281	81, 936	78, 389	100, 216
Stone:						
Basalt and related rocks--------tons--	10, 588, 151	10, 742, 925	11, 773, 146	11, 984, 365	13, 905, 037	13, 491, 381
Granite--------do----	6, 244, 900	7, 324, 753	8, 464, 343	9, 712, 940	8, 669, 466	9, 821, 793
Limestone—						
For agricultural uses----tons--	68, 849, 909	77, 699, 459	1, 678, 845	2, 001, 665	1, 983, 250	2, 408, 182
For other uses ----------tons--			81, 680, 020	88, 409, 953	85, 890, 423	88, 933, 014
Marble--------do----	468, 105	511, 785	510, 897	544, 363	525, 702	502, 269
Sandstone-----do----	3, 533, 185	4, 063, 559	4, 516, 423	4, 581, 803	4, 278, 742	5, 252, 754
Other stone---do----	3, 922, 320	4, 755, 565	4, 316, 934	6, 454, 486	6, 191, 122	7, 602, 395
	93, 606, 570	105, 098, 046	112, 940, 608	123, 689, 575	121, 443, 742	128, 011, 788

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[2] Production reported, but figures not available for publication.

[12] Data not available.

[16] Includes output of the Philippine Islands.

[28] Nickel content of nickel salts and metallic nickel produced as a by-product in electrolytic refining of copper.

[29] Estimated output.

[30] Includes by-product pyrites from zinc operations in Wisconsin and New York and pyrite and pyrrhotite concentrates from copper operations in Tennessee. Similar output from Wisconsin and Tennessee not included in the figures for earlier years. The production of pyrite and pyrrhotite concentrates in Tennessee began in 1925.

[31] Obtained in large part as a by-product in electrolytic refining of copper.

[32] Includes carbonate, bicarbonate, sulphate, and trona.

Mineral production of the United States of America, 1924–1929—Continued

Mineral	1924	1925	1926	1927	1928	1929
Sulphur .... tons	1, 240, 151	1, 431, 881	1, 920, 362	2, 145, 509	2, 013, 682	2, 400, 305
Talc and soapstone (sales)[33] .... tons	184, 902	165, 339	164, 715	174, 465	184, 136	199, 383
Tantalum ores: Columbite (shipments) .... kilograms	543	....	953	490	15, 830	10, 032
Tellurium[34] .... do	([12])	([12])	416	753	1, 175	5, 175
Tin, metallic[35] .... tons	6	13	7	24	43	35
Titanium ores:						
Ilmenite concentrates[36] .... tons	4, 326	5, 049	[37] 1, 366	3, 175	833	([2])
Rutile concentrates[38] .... tons	....	42	[37] 27	475	100	([2])
Tungsten concentrates (sales)[39] .... tons	513	1, 080	1, 254	1, 056	1, 096	753
Uranium ore (shipments) .... tons Vanadium ore (shipments) .... tons	([2])	11, 857	19, 617	([2])	([2])	([2])
Zinc:						
Mine production[19] .... kilograms	578, 759, 975	644, 866, 181	702, 668, 062	651, 846, 024	630, 644, 321	657, 231, 952
Smelter production, primary zinc—						
From domestic ores .... kilograms	467, 951, 567	504, 057, 331	555, 185, 995	523, 406, 573	536, 619, 650	555, 317, 536
From foreign ores .... kilograms	1, 368, 027	15, 707, 821	5, 834, 075	14, 112, 092	10, 029, 782	12, 075, 473
	469, 319, 594	519, 765, 152	561, 020, 070	537, 518, 665	546, 649, 432	567, 393, 009
Zircon (shipments) .... tons	255	566	1, 172	3, 308	([2])	....

[2] Production reported, but figures not available for publication.
[12] Data not available.
[19] Recoverable content of ores.
[33] Beginning with 1925, figures represent talc only. Production of soapstone is reported, but the figure are not available for publication.
[34] Obtained as a by-product in electrolytic refining of copper.
[35] Metallic tin obtainable from domestic concentrates produced in tin mining. Smelter production of metallic tin in 1924 reported as 441 tons. No output reported for 1925–1929, inclusive.
[36] Average content of TiO_2 reported as follows: 1924 to 1926, 52 per cent; 1927 and 1928, 50 per cent; 1929 figures not available for publication.
[37] Figures for Florida only; production in Virginia reported, but figures not available for publication.
[38] Average content of TiO_2 reported as follows: 1925 to 1927, 95 per cent; 1928, 93-96 per cent; 1929, figures not available for publication.
[39] Reduced to equivalent of 60 per cent of WO_3.

URUGUAY

Agriculture in Uruguay to date has proved more profitable than mining, and the mineral industry has remained virtually undeveloped. The minerals reported[64] in the country include arsenic, asbestos, bismuth, borax, coal, copper, emery, gem stones (agate, amethyst, topaz), gold, graphite, iron, kaolin, fire clay and other clays, lead, manganese, marble and other building stones, mercury, peat, slate, sulphur, talc, tin, and zinc. The only minerals of present economic value, however, are agate, clay, sand, stone, and talc. No figures of production are available; the exports of minerals of domestic origin are reported as follows for 1924 to 1929, inclusve:

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[64] Information supplied by the American consulate, Montevideo; Marstrander, R., Informe Preliminar sobre las Riquesas Minerales de la República Oriental del Uruguay: Inst. Geol. y Perforac., Bol. 2, Montevideo, 1916.

Minerals exported from Uruguay, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Agate rock..............tons..	99	5	81	78	22	42
Asphalt rock............do....	----------	----------	72	----------	----------	----------
Calcium carbonate.......do....	56	165	----------	----------	----------	----------
Clay:						
Fire clay........kilograms..	2,030	----------	----------	----------	----------	----------
Other [2]..............tons..	6	----------	54	5,833	3,044	3,465
Coal [3]...............do....	1,711	----------	131	132,408	108,530	132,975
Gold...................grams..	380	230	460	----------	----------	----------
Gypsum..................tons..	10	----------	----------	----------	----------	----------
Manganese, powdered..do....	----------	----------	39	----------	----------	----------
Sand......................do....	1,410	1,568	1,572	1,937	2,171	2,350
Sodium carbonate.......do....	5	----------	----------	----------	----------	----------
Stone:						
Granite, rough......do....	20	----------	13	----------	----------	----------
Limestone..........do....	600	----------	9	100	751	1,434
Marble...............do....	364	144	71	96	5	----------
Paving stones...number..	4,183,470	6,008,860	2,016,900	----------	----------	----------
tons..	----------	----------	3,999	13,855	15,005	7,146
Other—						
Dressed..........do....	1,828	1,580	4,319	2,093	1,550	46
Ground...........do....	5,220	1,540	----------	----------	----------	----------
Rough............do....	103,667	179,610	363,658	418,028	481,239	437,164
Talc:						
Rock.................do....	1,754	849	828	983	985	786
Powdered...........do....	6	64	69	220	36	157
Whiting...........kilograms..	250	----------	----------	----------	----------	----------

[1] Source of data: Uruguay, Dirección General de Estadística; Anuario Estadístico, pt. 3ª, Comercio Exterior, Montevideo (annual). Reported as domestic produce.

[2] Includes some cement material.

[3] Believed to be reexports, as no production of coal in Uruguay is recorded.

VENEZUELA

Mineral production of Venezuela, 1924-1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Asphalt.................tons..	69,892	33,679	51,552	56,906	48,749	27,915
Briquets, fuel..........do....	3,475	2,043	2,399	2,297	1,232	1,691
Coal [2]...................do....	16,695	16,798	15,928	16,104	15,812	16,859
Copper:						
Ore.....................do....	37,431	46,836	23,218	2,377	----------	----------
Matte.........kilograms..	3,715,000	4,991,000	----------	----------	----------	----------
Gold, fine...............grams..	[3] 654,386	[3] 949,963	895,599	1,459,563	[3] 1,434,088	[3] 1,445,596
Petroleum, crude.......tons..	1,334,996	2,884,487	5,207,450	9,384,403	15,711,558	20,401,954
Salt.......................do....	[4] 30,000	[4] 30,000	23,865	20,803	26,228	25,443

[1] Information furnished by Dirección de Minas, Venezuela, through the American consulate, Caracas, except as otherwise stated.

[2] Exclusive of the output of the State of Falcón, which is estimated to be approximately 8,000 tons annually.

[3] Figures as published by the Imp. Inst., London, converted from troy ounces to grams.

[4] Approximate production. (Imp. Inst., London.)

YUGOSLAVIA

Mineral production of Yugoslavia, 1924–1929 [1]

Mineral	1924	1925	1926	1927	1928	1929
Abrasives: Millstones ....number..	(²)	2, 163	1, 395	1, 071	[3] 980	[3] 999
Antimony:						
Ore ....tons..	1, 726	579	760	1, 162	1, 075	874
Liquated ....do....	185	----------	----------	----------	----------	----------
Oxide ....do....	20	----------	----------	----------	----------	----------
Regulus ....do....	19	63	95	149	129	122
Asphalt ....do....	97	286	85	142	535	61
Bauxite ....do....	18, 485	79, 032	131, 828	100, 327	49, 264	103, 366
Briquets, fuel ....do....	----------	31, 255	(²)	(²)	27, 582	51, 477
Cement ....do....	[3] 29, 248	700, 000	585, 004	(²)	825, 360	(²)
Chromite, crude ....do....	300	12, 160	15, 983	8, 757	16, 678	43, 022
Coal:						
Bituminous ....do....	131, 633	178, 456	190, 814	287, 728	457, 472	408, 611
Lignite ....do....	4, 053, 607	3, 973, 870	3, 976, 938	4, 458, 491	4, 694, 408	5, 242, 527
Copper:						
Ore ....do....	[3] 145, 107	176, 058	220, 005	287, 940	327, 793	329, 282
Metal (smelter product) ....kilograms..	8, 101, 000	7, 301, 000	9, 671, 000	12, 863, 000	15, 086, 000	20, 675, 000
Gold, fine [4] ....grams..	243, 000	236, 000	323, 000	386, 000	450, 000	574, 000
Gypsum, crude [3] ....tons..	----------	----------	620	1, 063	1, 170	2, 340
Iron:						
Ore ....do....	330, 119	139, 137	366, 624	336, 099	439, 481	427, 946
Pig iron ....do....	15, 019	3, 494	18, 768	22, 651	29, 303	30, 885
Lead:						
Ore and concentrates ....tons..	11, 675	78, 549	79, 531	(²)	94, 155	112, 809
Metal (smelter product) ....kilograms..	11, 487, 000	10, 956, 000	9, 809, 000	[5] 10, 672, 000	13, 875, 000	9, 470, 700
Magnesite [3] ....do....	----------	----------	----------	1, 680	6, 267	6, 615
Manganese ore ....do....	4, 570	2, 716	1, 244	1, 971	2, 660	3, 072
Molybdenum concentrates ....do....	6	----------	----------	----------	----------	----------
Natural gas ......cubic meters..	(²)	772, 845	644, 378	603, 947	930, 391	1, 536, 821
Pyrite ....tons..	[3] 26, 306	38, 988	53, 376	57, 003	64, 273	61, 153
Salt ....do....	48, 864	48, 499	52, 260	54, 765	52, 128	44, 564
Silver, fine [4] ....kilograms..	972	812	1, 400	1, 672	1, 950	2, 488
Stone: Marble ....tons..	2, 517	2, 194	3, 062	3, 070	1, 839	3, 084
Zinc:						
Ore ....do....	549	535	581	1, 067	1, 153	1, 135
Metal (smelter product) ....kilograms..	2, 126, 000	2, 075, 000	2, 376, 000	3, 185, 000	4, 883, 000	6, 290, 800

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[1] Information furnished by the Government of Yugoslavia through the American consulate, Belgrade, except as otherwise noted.

[2] Data not available.

[3] Output of Serbia only.

[4] Figures as published by the Director, U. S. Mint.

[5] Figures as published by Imp. Inst., London.

ZANZIBAR PROTECTORATE

No mines are known in the Zanzibar Protectorate, which includes the island of Pemba. Some clay is dug for making native pottery, and limestone is quarried for local use and for export to Uganda.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA[1]

(MINE REPORT)

By V. C. Heikes[2]

CONTENTS

	Page
Summary	963
Mining industry	971
Ore classification	974
Metallurgic industry	977
Review by counties and districts	982
Alameda County	982
Amador County	983
Butte County	984
Calaveras County	986
Contra Costa County	989
Del Norte County	989
Eldorado County	990
Fresno County	991
Humboldt County	992
Imperial County	992
Inyo County	992
Kern County	994
Lassen County	996
Madera County	997
Mariposa County	997
Merced County	998

Review by counties and districts – Contd.

	Page
Mono County	998
Napa County	999
Nevada County	999
Placer County	1002
Plumas County	1003
Riverside County	1006
Sacramento County	1007
San Bernardino County	1008
San Diego County	1011
San Luis Obispo County	1012
Shasta County	1012
Sierra County	1014
Siskiyou County	1016
Stanislaus County	1019
Trinity County	1020
Tulare County	1022
Tuolumne County	1022
Ventura County	1025
Yuba County	1025

SUMMARY

The output of gold, silver, copper, and lead from California mines in 1930 was valued at $13,801,004, a decrease of 9 per cent compared with 1929. Gold increased 11 per cent, silver increased 38 per cent in quantity and decreased less than 1 per cent in value, copper decreased 18 per cent in quantity and 39 per cent in value, and lead increased 149 per cent in quantity and 98 per cent in value. No zinc has been reported produced in the State since 1927.

The value of metals produced from 481 lode mines in 1930 was $10,041,000, a decrease of 10 per cent compared with the output of 324 lode mines in 1929. Gold produced at lode mines in 1930 ($5,696,019) was 22 per cent more than in 1929, and silver (1,610,177 ounces, valued at $619,918) was 38 per cent more in quantity and a small fraction less in value. The quantity of ore, old tailings, etc., from lode mines in 1930 (1,595,150 short tons) was 4 per cent less than in 1929.

The total value of gold and silver produced by 892 placer-mine operators in 1930 was $3,760,004, a decrease of 3 per cent compared with the output of 478 placer mines in 1929. The placer gold production ($3,755,143) was 3 per cent less than in 1929, and the placer silver (12,626 ounces, valued at $4,861) was 5 per cent less in quantity and 31 per cent less in value than in 1929. The placer output of gold and silver in 1930 was from the operation of 24 dredges, 88 drift mines, 79 hydraulic mines, and 701 surface mines.

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[1] Work on manuscript completed December, 1931.

[2] Helen M. Gaylord assisted by B. N. Lowry, both of the Bureau of Mines, prepared the statistics for this report.

The total value of gold, silver, copper, lead, and zinc produced from 1848 to 1930, inclusive, is recorded by the Bureau of Mines as $2,120,516,451.

The figures by decades are given in the following table. For details by years through 1926 the reader is referred to the report[3] by J. M. Hill, published in 1929.

Gold, silver, copper, lead, and zinc in California, 1848–1930, by decades

Decade	Gold [a]			Silver [b]	
	Placer	Lode	Total	Fine ounces	Value
1848–1850	$51, 669, 767	----------	$51, 669, 767	353, 000	$465, 960
1851–1860	581, 561, 868	$5, 874, 362	587, 436, 230	4, 017, 000	5, 402, 865
1861–1870	211, 388, 439	23, 487, 604	234, 876, 043	1, 755, 000	2, 342, 925
1871–1880	120, 910, 077	51, 818, 604	172, 728, 681	6, 152, 000	7, 530, 048
1881–1890	37, 881, 328	113, 643, 986	151, 525, 314	12, 899, 017	13, 540, 200
1891–1900	29, 416, 001	117, 664, 005	147, 080, 006	6, 012, 310	4, 139, 070
1901–1910	63, 569, 813	118, 337, 674	181, 907, 487	12, 848, 365	7, 372, 497
1911–1920	84, 739, 988	107, 249, 344	191, 989, 332	15, 680, 607	11, 648, 499
1921–1930	53, 403, 873	68, 923, 492	122, 327, 365	24, 819, 451	18, 447, 572
	1, 234, 541, 154	606, 999, 071	1, 841, 540, 225	84, 536, 750	70, 889, 636

Decade	Copper [c]		Lead [d]		Zinc [e]		Total value [f]
	Pounds	Value	Pounds	Value	Pounds	Value	
1848–1850	----------	----------	----------	----------	----------	----------	$52, 135, 727
1851–1860	----------	----------	----------	----------	----------	----------	592, 839, 095
1861–1870	19, 130, 000	$6, 681, 810	----------	----------	----------	----------	243, 900, 778
1871–1880	4, 132, 000	936, 232	65, 214, 000	$3, 531, 370	----------	----------	184, 726, 331
1881–1890	8, 047, 834	1, 234, 010	24, 480, 000	1, 088, 300	----------	----------	167, 387, 824
1891–1900	91, 293, 128	13, 669, 971	10, 013, 900	375, 085	----------	----------	165, 264, 132
1901–1910	325, 162, 456	47, 553, 335	10, 327, 122	477, 678	439, 550	$26, 345	237, 337, 342
1911–1920	361, 685, 828	71, 644, 845	70, 918, 299	4, 910, 542	55, 022, 707	5, 950, 996	286, 144, 214
1921–1930	307, 827, 048	43, 456, 338	46, 008, 115	3, 215, 054	46, 904, 883	3, 334, 679	190, 781, 008
	1, 117, 278, 294	185, 176, 541	226, 961, 436	13, 598, 029	102, 367, 140	9, 312, 020	2, 120, 516, 451

[a] Gold figures, 1848-1883, from table compiled by C. G. Yale and published in 13th Ann. Rept. of the California State Mineralogist; figures, 1884-1902, from mint agents' statements in the annual reports of the Director of the Mint; figures, 1902 to date, from annual chapters, Gold, Silver, Copper, Lead, and Zinc in California, published in Mineral Resources of the United States.

[b] Silver figures, 1848-1880, by decades, estimated by J. M. Hill (see discussion "Sources of silver production"); figures, 1891-1903, from mint agents' statements in the annual reports of the Director of the Mint (ounces and value calculated from original figures given as coinage value); figures, 1904 to date, from annual chapters, Gold, Silver, Copper, Lead, and Zinc in California, published in Mineral Resources of the United States.

[c] Copper figures, 1862-1904, from chapter on Copper in Mineral Resources of the United States, 1915, Pt. I, p. 663; figures, 1905 to date, from annual chapters, Gold, Silver, Copper, Lead, and Zinc in California, published in Mineral Resources of the United States.

[d] Lead figures, 1870-1876, estimated by J. M. Hill from various data; figures, 1877-1881, from chapter on Lead in Mineral Resources of the United States, 1912, Pt. I, p. 339; figures, 1882-1886, from annual chapters on Lead in Mineral Resources volumes; figures, 1887-1903, from 18th Ann. Rept. of the California State Mineralogist, p. 451; figures, 1904 to date, from annual chapters, Gold, Silver, Copper, Lead, and Zinc in California, published in Mineral Resources of the United States.

[e] Zinc figures from annual chapters, Gold, Silver, Copper, Lead, and Zinc in California, published in Mineral Resources of the United States.

[f] Value of gold, $20.671835 a fine ounce. Value of other metals calculated from price table published in preface to the Metals volumes (Pt. I) of Mineral Resources of the United States.

[3] Hill, J. M., Historical Summary of Gold, Silver, Copper, Lead, and Zinc Produced in California, 1848 to 1926: Econ. Paper 3, Bureau of Mines, 1929, 22 pp.

The value of metal production herein reported for 1921 to 1930 has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in California, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	294	279	1,215,600	759,720.76	$15,704,822	3,629,223	$3,629,223
1922	283	282	1,539,933	709,677.99	14,670,346	3,100,065	3,100,065
1923	268	353	1,535,691	647,209.75	13,379,013	3,559,443	2,918,743
1924	267	266	2,019,200	636,139.72	13,150,175	3,555,133	2,381,939
1925	332	359	1,938,679	632,035.31	13,065,330	3,054,416	2,119,765
1926	335	483	1,760,859	576,798.40	11,923,481	2,022,460	1,262,015
1927	318	465	1,526,410	564,585.50	11,671,018	1,620,242	918,677
1928	287	460	1,702,541	521,739.59	10,785,315	1,478,771	865,081
1929	324	478	1,657,069	412,479.25	8,526,703	1,176,895	627,285
1930	481	892	1,595,150	457,199.98	9,451,162	1,622,803	624,779

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	11,743,404	$1,514,899	1,124,276	$50,592	846,184	$42,309	$20,941,845
1922	22,539,485	3,042,830	6,312,536	347,189	3,012,950	171,738	21,332,168
1923	28,317,759	4,162,711	9,549,680	668,478	-----------	-----------	21,128,945
1924	52,107,171	6,826,039	4,763,806	381,104	3,060,000	198,900	22,938,157
1925	46,864,913	6,654,818	6,566,200	571,259	11,489,237	873,182	23,284,354
1926	33,466,299	4,685,282	8,093,513	647,481	20,433,887	1,532,542	20,050,801
1927	27,133,008	3,554,424	2,718,014	171,235	8,062,625	516,008	16,831,362
1928	25,150,743	3,621,707	1,891,037	109,680	-----------	-----------	15,381,783
1929	33,218,994	5,846,543	1,429,489	90,058	-----------	-----------	15,090,589
1930	27,285,272	3,547,085	3,559,564	177,978	-----------	-----------	13,801,004

Gold and silver produced at placer mines in California, 1921–1930

Year	Dredge				Drift			
	Gold		Silver		Gold		Silver	
	Fince ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
1921	375, 234. 56	$7, 756, 787	36, 322	$36, 322	6, 163. 51	$127, 411	615	$615
1922	241, 837. 04	4, 999, 215	16, 608	16, 608	12, 220. 79	252, 626	1, 391	1, 391
1923	293, 429. 92	6, 065, 735	17, 569	14, 407	8, 938. 31	184, 771	955	783
1924	208, 279. 59	4, 305, 521	14, 793	9, 911	4, 768. 22	98, 568	560	375
1925	229, 821. 98	4, 750, 842	16, 478	11, 436	3, 218. 07	66, 523	358	248
1926	239, 482. 59	4, 950, 545	17, 287	10, 787	5, 381. 06	111, 236	942	588
1927	264, 220. 81	5, 461, 929	18, 530	10, 507	6, 865. 82	141, 929	835	473
1928	214, 345. 43	4, 430, 913	14, 510	8, 488	7, 420. 05	153, 386	799	467
1929	173, 630. 38	3, 589, 259	11, 510	6, 135	4, 095. 82	84, 668	450	240
1930	166, 980. 85	3, 451, 801	10, 753	4, 140	3, 029. 01	62, 615	426	164

Year	Hydraulic				Surface				Total value
	Gold		Silver		Gold		Silver		
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	
1921	7, 875. 84	$162, 808	864	$864	5, 215. 70	$107, 818	829	$829	$8, 193, 454
1922	7, 656. 57	158, 275	906	906	4, 341. 10	89, 739	708	708	5, 519, 468
1923	5, 409. 68	111, 828	626	513	7, 752. 06	160, 249	1, 155	947	6, 539, 233
1924	2, 911. 93	60, 195	409	274	6, 002. 77	124, 088	928	622	4, 599, 554
1925	8, 482. 30	175, 345	958	665	5, 003. 61	103, 434	785	545	5, 109, 038
1926	3, 344. 62	69, 139	450	281	4, 715. 72	97, 483	683	426	5, 240, 485
1927	5, 845. 25	120, 832	700	397	5, 448. 14	112, 623	838	475	5, 849, 165
1928	4, 426. 90	91, 512	538	315	8, 456. 80	174, 818	1, 364	798	4, 860, 697
1929	2, 889. 55	59, 732	445	237	6, 624. 85	136, 948	907	483	3, 877, 702
1930	4, 324. 88	89, 403	466	179	7, 320. 31	151, 324	981	378	3, 760, 004

GOLD

The mine production of gold in California in 1930 was $9,451,162, an increase of $924,459 compared with the output in 1929, when for the first time since the beginning of gold mining in 1848 it amounted to less than $10,000,000. California produced more gold in 1930 than any other State and was followed by Alaska, South Dakota, and Colorado. The output from lode mines increased from $4,656,096 in 1929 to $5,696,019 in 1930. Of the total gold produced lode mines yielded 60 per cent and placer mines 40 per cent in 1930, compared with 55 and 45 per cent, respectively, in both 1929 and 1928, about 50 per cent each in 1927, and 56 and 44 per cent, respectively, in 1926. From 1921 to 1929 the gold output of the State decreased gradually, but in 1930 the industry seemed to reflect the more favorable conditions for gold mining.

The chief gold-producing districts, in order to output, were the Grass Valley-Nevada City region in Nevada County (chiefly lode gold), Folsom-Natoma district in Sacramento County (chiefly gold dredging), Jackson-Sutter Creek district in Amador County (chiefly lode gold), Yuba River-Marysville district in Yuba County (chiefly gold dredging), Alleghany-Forest district in Sierra County (chiefly lode gold), Genesee Valley district in Plumas County (copper mining), and Lewiston district in Trinity County (chiefly gold dredging).

The output of placer gold in 1930 was $3,755,143, a decrease of $115,464 from 1929. Of the total placer gold $3,451,801 was recovered by 24 dredges, a decrease of $137,458 from the output of 25 dredges in 1929, whereas the surface and hydraulic mines yielded $240,727, an increase of $44,047 over 1929. Dredges recovered 92 per cent of the placer gold in 1930 (93 per cent in 1929); surface placers, 4 per cent; hydraulic mines, 2 per cent; and drift mines, 2 per cent. Dredges operated in 9 counties, named in order of output in 1930 as follows: Sacramento, Yuba, Trinity, Amador, Stanislaus, Butte, Merced, Shasta, and Calaveras.

The chief lode gold-producing counties of the State in 1930, named in order of output, were Nevada, Amador, Sierra, and Plumas, each with a production of over 18,000 ounces.

Gold ore, old tailings, etc., sold or treated in 1930 yielded 90 per cent of the total gold from lode mines; copper ore, smelter cleanings, etc., nearly 9 per cent; silver ore, 1 per cent; and lead ore, less than 1 per cent. Amalgamation mills in 1930 recovered 66 per cent of the lode-gold output, cyanidation plants 16 per cent, and smelters 18 per cent, compared with 71, 14, and 15 per cent, respectively, in 1929. The ore amalgamated (543,750 tons) averaged $6.98 in recovered gold and 0.08 ounce of silver to the ton.

Pocket mining in 1930 contributed $208,805 (nearly 4 per cent) to the total lode-gold output of the State. Most of this gold was recovered from ore treated in hand mortars and panned from rich pocket material and specimens. Counties in which pocket mining was reported were Amador, Butte, Calaveras, Eldorado, Mariposa, Nevada, Plumas, Sacramento, Shasta, Sierra, Siskiyou, Trinity, and Tuolumne.

Twenty-seven mining companies in 1930 produced more than 1,000 ounces of gold each and contributed 89 per cent of the total output of the State. Of these companies, 2 produced over 50,000 ounces each, and 3 others produced over 20,000 ounces each. Ten of the companies operated dredges, 2 operated silver mines, 2 operated copper mines, and 13 operated gold lode mines. The 10 largest gold producers in California in 1930, in order of output, were the Empire Star Mines Co. (Ltd.) (gold lode), Natomas Co. (6 dredges), Yuba Consolidated Gold Fields (4 dredges), Kennedy Mining & Milling Co. (gold lode), Argonaut Mining Co. (gold lode), Original Sixteen to One Mines (Inc.) (gold lode), Central Eureka Mining Co. (gold lode), Capital Dredging Co. (3 dredges), Walker Mining Co. (copper mine), and Idaho Maryland Mines Co. (gold lode).

SILVER

The mine production of silver in California in 1930 was 1,622,803 ounces, valued at $624,779, an increase of 445,908 ounces but a decrease of $2,506 compared with 1929. The leading silver-producing counties in 1930, in order of output, were San Bernardino (mostly from silver ore), Plumas (mostly from copper ore), Napa (from silver ore), and Inyo (mostly from lead ore); their output ranged from 463,625 ounces in San Bernardino County to 111,587 ounces in Inyo County. Virtually all the silver ore mined came from two districts, the Randsburg in San Bernardino County and the Calistoga in Napa County; the total output of silver ore amounted to 26,711 tons and yielded 721,559 ounces of silver or 45 per cent of the total from lode mines. Copper ore, smelter cleanings, etc., yielded 670,398 ounces of silver or 42 per cent of the total from lodes; dry gold ore, old tailings, etc., yielded 6 per cent; and lead ore yielded 7 per cent. Concentrates yielded 60 per cent of the lode silver; first-class smelting ore and smelter cleanings, 37 per cent; and bullion from amalgamation and cyanidation mills, 3 per cent.

The 29 largest silver-producing companies in 1930 produced 1,398,903 ounces of silver, or 86 per cent of the State's output. No company produced more than 500,000 ounces; 3 produced between 100,000 and 500,000 ounces each, 1 between 50,000 and 100,000 ounces, and 25 less than 50,000 but more than 1,000 ounces each. The 10 largest silver-producing companies in California in 1930, in order of output, were the Wortley Consolidated Mines (Inc.) (operating the Kelly-Uranium and Santa Fe silver properties), Walker Mining Co., Banner Development Co., American Smelting & Refining Co. (Estelle and Cerro Gordo mines), Engels Copper Mining Co., American Foundation Co. (Murchie mine), Empire Star Mines Co. (Ltd.), New Sutherland Divide Mining Co. (Carbonate mine), Zenda Gold Mining Co., and Island Copper Co.

COPPER

The mine production of copper in California in 1930 was 27,285,272 pounds, valued at $3,547,085, a decrease of 5,933,722 pounds from 1929. The mining of copper ore was considerably curtailed at the end of the year, due to the surplus stocks and the lower price. Copper ore was shipped from 22 mines in the State; but 6 properties—the Walker and Engels mines in Plumas County, the Mountain Copper mine in Shasta County, the Calaveras Copper mine in Calaveras County, the Island Copper mine in Trinity County, and the Blue Ledge mine in Siskiyou County, named in order of output—yielded 96 per cent of the total copper produced in the State. Copper ore yielded 97 per cent of the total copper. Nearly 89 per cent of the copper came from concentrates, and 6 per cent came from crude ore of all kinds shipped to smelters; the remainder (5 per cent) came from smelter cleanings resmelted and from the smelting of cement copper obtained by leaching residue from the roasting of pyrites for the manufacture of sulphuric acid.

The copper ore produced in the State in 1930 had an average assay content of 0.022 ounce of gold and 0.55 ounce of silver to the ton and 1.59 per cent of copper.

LEAD

The mine production of lead in California in 1930 was 3,559,564 pounds, valued at $177,978, an increase of 2,130,075 pounds compared with 1929. The output of lead from Inyo County, which accounted for 96 per cent of the total production recorded for the State, increased 155 per cent. Only a small quantity of lead was reported from mines in San Bernardino County. Ninety-six per cent of the lead was contained in lead ore shipped direct to smelters; 2 per cent was recovered from concentrates, mainly by flotation.

Mine production of gold, silver, copper, and lead in California in 1930, by counties, in terms of recovered metals

County	Mines producing		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alameda	1							
Amador	23	9	80, 461. 75	$1, 663, 292	8, 557. 49	$176, 899	89, 019. 24	$1, 840, 191
Butte	11	78	398. 08	8, 229	5, 738. 69	118, 629	6, 136. 77	126, 858
Calaveras	32	27	3, 678. 98	76, 051	1, 783. 19	36, 862	5, 462. 17	112, 913
Del Norte		2			13. 51	279	13. 51	279
Eldorado	35	28	3, 195. 84	66, 064	578. 33	11, 955	3, 774. 17	78, 019
Fresno	2	2	26. 78	554	259. 41	5, 362	286. 19	5, 916
Humboldt	4	7	34. 71	717	74. 38	1, 538	109. 09	2, 255
Imperial		1			7. 14	148	7. 14	148
Inyo	22	1	985. 96	20, 381	4. 09	85	990. 05	20, 466
Kern	35	4	7, 896. 37	163, 232	106. 56	2, 203	8, 002. 93	165, 435
Lassen	4		142. 53	2, 946			142. 53	2, 946
Madera	4	3	40. 04	828	11. 32	234	51. 36	1, 062
Mariposa	24	27	2, 694. 00	55, 690	159. 39	3, 295	2, 853. 39	58, 985
Merced		1			4, 272. 89	88, 328	4, 272. 89	88, 328
Mono	7		1, 269. 05	26, 234			1, 269. 05	26, 234
Napa	1		1, 767. 22	36, 532			1, 767. 22	36, 532
Nevada	65	83	104, 615. 23	2, 162, 589	1, 494. 64	30, 897	106, 109. 87	2, 193, 486
Placer	4	97	171. 91	3, 554	1, 247. 31	25, 784	1, 419. 22	29, 338
Plumas	13	103	18, 052. 91	373, 187	1, 556. 33	32, 172	19, 609. 24	405, 359
Riverside	8		233. 78	4, 833			233. 78	4, 833
Sacramento	2	14	39. 07	808	83, 393. 88	1, 723, 904	83, 432. 95	1, 724, 712
San Bernardino	48	8	2, 800. 86	57, 899	74. 63	1, 543	2, 875. 49	59, 442
San Diego	6		108. 05	2, 234			108. 05	2, 234
San Luis Obispo		1			70. 70	1, 461	70. 70	1, 461
Shasta	24	69	8, 214. 05	169, 799	2, 729. 06	56, 415	10, 943. 11	226, 214
Sierra	17	46	26, 964. 00	557, 395	1, 540. 93	31, 854	28, 504. 93	589, 249
Siskiyou	21	107	1, 578. 22	32, 625	1, 824. 08	37, 707	3, 402. 30	70, 332
Stanislaus		5			5, 279. 36	109, 134	5, 279. 36	109. 134
Trinity	13	88	1, 536. 12	31, 754	14, 427. 79	298, 249	15, 963. 91	330, 003
Tulare	2		1. 75	36			1. 75	36
Tuolumne	49	16	3, 198. 85	66, 126	75. 71	1, 565	3, 274. 56	67, 691
Ventura	1		10. 68	221			10. 68	221
Yuba	3	65	492. 14	10, 173	46, 374. 24	958, 641	46, 866. 38	968, 814
Undistributed [1]			4, 936. 00	102, 036			4, 936. 00	102, 036
	481	892	275, 544. 93	5, 696, 019	181, 655. 05	3, 755, 143	457, 199. 98	9, 451, 162
Total, 1929	324	478	225, 238. 65	4, 656, 096	187, 240. 60	3, 870, 607	412, 479. 25	8, 526, 703

[1] Figures represent metals recovered from old smelter cleanings, etc. (see Contra Costa County, p. 989).

Mine production of gold, silver, copper, and lead in California in 1930, by counties, in terms of recovered metals—Con.

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alameda	41	$16			41	$16
Amador	17,483	6,731	958	$369	18,441	7,100
Butte	598	230	499	192	1,097	422
Calaveras	3,917	1,508	121	47	4,038	1,555
Del Norte			2	1	2	1
Eldorado	584	225	66	25	650	250
Fresno	14	5	41	16	55	21
Humboldt	13	5	11	4	24	9
Imperial						
Inyo	111,585	42,960	2	1	111,587	42,961
Kern	4,535	1,746	29	11	4,564	1,757
Lassen	59	23			59	23
Madera	180	69	3	1	183	70
Mariposa	794	306	32	12	826	318
Merced			378	146	378	146
Mono	8,224	3,166			8,224	3,166
Napa	266,386	102,559			266,386	102,559
Nevada	60,379	23,246	182	70	60,561	23,316
Placer	25	10	164	63	189	73
Plumas	425,838	163,948	200	77	426,038	164,025
Riverside	100	38			100	38
Sacramento	8	3	3,403	1,310	3,411	1,313
San Bernardino	463,618	178,493	7	3	463,625	178,496
San Diego	27	10			27	10
San Luis Obispo			3	1	3	1
Shasta	13,775	5,303	360	139	14,135	5,442
Sierra	5,182	1,995	158	61	5,340	2,056
Siskiyou	10,537	4,057	299	115	10,836	4,172
Stanislaus			541	208	541	208
Trinity	15,477	5,959	1,926	741	17,403	6,700
Tulare	808	311			808	311
Tuolumne	772	297	8	3	780	300
Ventura	5	2			5	2
Yuba	27	10	3,233	1,245	3,260	1,255
Undistributed [1]	199,186	76,687			199,186	76,687
	1,610,177	619,918	12,626	4,861	1,622,803	624,779
Total, 1929	1,163,583	620,190	13,312	7,095	1,176,895	627,285

County	Copper		Lead		Grand total value
	Pounds	Value	Pounds	Value	
Alameda	84,812	$11,026			$11,042
Amador					1,847,291
Butte	353	46			127,326
Calaveras	1,857,141	241,428	1,297	$65	355,961
Del Norte					280
Eldorado					78,269
Fresno					5,937
Humboldt	1,919	249			2,513
Imperial					148
Inyo	17,747	2,307	3,421,668	171,083	236,817
Kern					167,192
Lassen					2,969
Madera	98	13	4,993	250	1,395
Mariposa	3,720	484			59,787
Merced					88,474
Mono	1,996	259			29,659
Napa	9,257	1,203	464	23	140,317
Nevada	16,945	2,203	17,812	891	2,219,896
Placer					29,411
Plumas	19,529,224	2,538,799			3,108,183
Riverside	5,877	764			5,635
Sacramento					1,726,025
San Bernardino	34,029	4,424	44,958	2,248	244,610
San Diego					2,244
San Luis Obispo					1,462
Shasta	3,962,383	515,110			746,766
Sierra					591,305
Siskiyou	405,868	52,763	470	23	127,290
Stanislaus					109,342
Trinity	588,574	76,515			413,218
Tulare			317	16	363
Tuolumne	4,673	607			68,598
Ventura					223
Yuba					970,069
Undistributed [1]	760,656	98,885	67,585	3,379	280,987
	27,285,272	3,547,085	3,559,564	177,978	13,801,004
Total, 1929	33,218,994	5,846,543	1,429,489	90,058	15,090,589

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[1] Figures represent metals recovered from old smelter cleanings, etc. (see Contra Costa County, p. 989)

MINING INDUSTRY

In 1930 California again ranked as the chief gold-producing State. Gold mining was considerably revived; mines which had not been worked for 10 years or more were reopened or under investigation; and gold-bearing quartz veins, some of which have barely paid expenses for the past three years, became profitable. It is questionable, however, whether placer mining will again exceed the gold output from lode mining, as dredging ground in the State is becoming exhausted and hydraulic mining is still limited by the débris law. Attention was directed by some of the larger mining companies and individuals to acquiring gold properties; and the number of small operators and prospectors in various localities of the State, particularly in Butte, Placer, Plumas, Siskiyou, and Trinity Counties, increased. With the prices of the base metals falling off at the close of the year, curtailment in the copper and lead producing mines took place, and there were comparatively few shippers of lead and copper ore. Only three companies (four mines) in the State had a yield of over a million pounds of copper, and only one company had a yield of over a million pounds of lead. Twenty-two companies produced 86 per cent of the total value of all metals produced in the State in 1930; and 33 companies produced 89 per cent of the total metal value.

Lode mining yielded 1,595,150 tons of ore, old tailings, etc., in 1930, compared with 1,657,069 tons in 1929. The value of the metal output of the Walker Mining Co., operating a copper property in Plumas County, was the largest of any single mining company or district in the State, and Plumas County led in total value of metals produced in 1930. The counties ranking first in production of the various metals were as follows: Nevada in gold; San Bernardino in silver; Plumas in copper; and Inyo in lead.

The yield of gold by dredges in the State in 1930 was $3,451,801 from 24 dredges, compared with $3,589,259 from 25 dredges in 1929. The number of dredges working in the various counties was as follows: Amador, 1; Butte, 1; Calaveras, 1; Merced, 1; Sacramento, 9; Shasta, 1; Stanislaus, 1; Trinity, 3; and Yuba, 6. The total quantity of gravel dug by all dredges was 42,724,316 cubic yards (43,434,590 in 1929); and the average recovery in gold and silver was 8.09 cents a yard in 1930, compared with 8.28 cents in 1929, 9.03 cents in 1928, and 10.66 cents in 1927. The total production of gold by dredges since the beginning of the industry (on Feather River) has been $167,005,744, of which the Feather River field has yielded $33,371,994, the Yuba River field $65,188,756, and the American River field $40,843,416.

The world production of gold was summarized in a recent economic report[4] of the United States Bureau of Mines. The Bureau of Mines also collaborated with the United States Geological Survey in a detailed summary[5] relating to the gold resources and reserves in the United States. Gold was one of the main topics for discussion at the International Geologic Congress at Pretoria, South Africa, in 1929. As to the possible gold resources of California,

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[4] Ridgway, R. H., Summarized Data of Gold Production: Econ. Paper 6, Bureau of Mines, 1929, 63 pp.

[5] Gold Reserves of United States: Reprint from The Gold Resources of the World, 15th Internat. Geol. Cong., So. Africa, 1929.

T. B. Nolan and H. G. Ferguson[6] make the following statements and give bibliographical references:

Lode mines.—The Mother Lode district, in the central part of California, has been the largest producer in the State, its output through 1927 amounting to about 12,100,000 ounces. The lodes in this district are quartz veins dipping at rather low to high angles. The ore shoots are large and have been followed down the dip for as much as 6,000 feet. The ore mined at present averages about $7 a ton, but during the period of peak production it averaged between $3 and $4, owing to the lower grade of the ore bodies in mineralized country rock, few of which are now mined. The recent production has come largely from a small number of very deep mines, whose future life is limited by the improbability of mining at depths much below 8,000 feet. There is probably much ore below the workings in many of the shallow mines now idle, but the expense of reconditioning these mines and of deep exploration and mining would be prohibitive except under conditions of more greatly reduced costs than it would be reasonable to expect.

Next to the Mother Lode the Nevada City-Grass Valley district has been the largest producer. The principal recent production has come from two deep mines handling ore of rather low grade. With increasing depth, costs have increased in spite of increase in tonnage. It is expected that as soon as present reserves are mined and certain partly developed areas thoroughly explored these mines will close, and once they are closed it is extremely doubtful whether they will ever be reopened. If costs remain as at present the district will probably follow the life history of other dying districts, showing a generally declining production with occasional spasmodic increases. It is hardly likely that any decrease in costs would bring production up to anything like the old level.

The ores of the Alleghany district differ from those of the two previously mentioned in that the grade of the ore is extremely high but the ore shoots small and irregular. Production has increased in recent years, and as none of the mines are deep prospects are good for increasing production.

Other districts such as the French Gulch and Randsburg were formerly large producers but are now believed to be approaching exhaustion.

Copper mines.—Gold as a by-product of copper mining has never formed a notable part of California's output. The principal copper region in Shasta County is believed to have passed the peak of its production, and the Plumas County deposits probably have relatively small reserves.

Placers.—Surface placers in recent streams were formerly the chief source of gold but are now practically negligible. Dredging ground in the Great Valley along the base of the Sierra Nevada has furnished the bulk of the placer production since 1900, but the reserves of this ground will probably be exhausted within a few years.

Tertiary gravel capped by lava has yielded much gold by hydraulic and drift mining, but the areas suitable for drift mining are largely exhausted. Hydraulic mining was practically stopped by legislative enactment in 1884. Undoubtedly, considerable areas of gravel that might be hydraulicked exist, and it is possible that this form of mining may be permitted in the future if dams and settling basins are built. The availability of this reserve depends on political rather than geologic conditions.

Reserves.—It is to be expected that there will be a slow decline in production for a few years, followed by a rather sharp drop when the larger mines of the Mother Lode and Grass Valley are closed down and the dredging ground exhausted; then stable production or slight rise due to expected increase in the Alleghany output and possible resumption of hydraulic mining.

Estimated gold output of California, 1928–1950, in ounces

	Minimum	Maximum
Lodes:		
Mother Lode	2,000,000	3,000,000
Grass Valley-Nevada City	500,000	1,000,000
Alleghany	1,000,000	2,000,000
Minor districts	300,000	600,000
Gold from copper ores	200,000	700,000

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[6] See footnote 5.

	Minimum	Maximum
Placers:		
Stream placers	100, 000	100, 000
Dredging ground	800, 000	1, 500, 000
Drift mining	100, 000	200, 000
Hydraulic mining	0	1, 000, 000
	5, 000, 000	10, 000, 000

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Ore treated and gold and silver recovered at gold mills in Mother Lode counties in California in 1930[1]

County	Ore treated	Gold and silver recovered in bullion			Concentrates produced[2]	Gold and silver recovered from concentrates			Value of total recovery	
		Gold	Silver	Average value per ton of ore		Gold	Silver	Average value per ton of concentrates	Total	Average value per ton of ore
	Short tons	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*			
Amador	233, 849	64, 049. 75	12, 919	$5. 68	4, 184	16, 234. 82	4, 501	$80. 63	$1, 666, 336	$7. 13
Calaveras	9, 408	2, 202. 73	633	4. 87	167	495. 51	169	61. 72	56, 087	5. 96
Eldorado	9, 216	2, 701. 38	445	6. 08	189	494. 46	139	54. 37	66, 289	7. 19
Mariposa	5, 079	2, 590. 82	538	10. 59	21	78. 55	89	78. 95	55, 422	10. 91
Tuolumne	3, 986	2, 796. 07	361	14. 54	7	29. 37	19	87. 71	58, 553	14. 69
	261, 538	74, 340. 75	14, 896	5. 90	4, 568	17, 332. 71	4, 917	78. 85	1, 902, 687	7. 27
Total, 1929	230, 389	69, 094. 62	14, 136	6. 23	4, 449	14, 876. 83	5, 529	69. 79	1, 746, 325	7. 58

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[1] Old tailings, etc., excluded.

[2] Includes only concentrates recovered from gold ore.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in California, 1921-1930, with content in terms of recovered metals

DRY GOLD ORE

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	863, 720	353, 993. 36	108, 603	9, 878	640	
1922	984, 785	430, 809. 45	97, 128	3, 296	1, 981	
1923	789, 026	311, 477. 79	82, 787	192	288	
1924	986, 098	383, 796. 60	155, 869	700	5, 613	
1925	803, 712	359, 390. 88	104, 560	122		
1926	660, 095	306, 451. 20	98, 427	119, 846	3, 991	
1927	576, 976	261, 778. 49	97, 444	706	5, 552	
1928	743, 534	266, 832. 42	85, 521	2, 697	2, 800	
1929	548, 564	202, 574. 72	73, 593	8, 232	13, 379	
1930	704, 001	247, 856. 71	101, 441	20, 923	17, 925	

DRY SILVER ORE

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
1921	38, 846	8, 940. 86	3, 220, 927			
1922	67, 363	5, 092. 94	2, 375, 361	7, 514	215	
1923	136, 633	9, 979. 00	2, 762, 977	4, 950	4, 130	
1924	89, 760	8, 255. 74	2, 295, 683			
1925	82, 913	7, 073. 75	1, 992, 859			
1926	57, 231	4, 069. 57	1, 154, 087	714	679	
1927	42, 146	3, 134. 97	935, 145	18, 301	1, 261	
1928	53, 907	3, 249. 05	920, 617	2, 247	2, 520	
1929	25, 160	2, 247. 68	481, 300	4, 356	249	
1930	26, 711	3, 718. 49	721, 559	9, 257	464	

COPPER ORE

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
1921	306, 134	1, 439. 01	175, 870	11, 599, 540		
1922	447, 200	5, 728. 85	320, 977	21, 845, 111	214	
1923	571, 645	8, 523. 74	360, 345	28, 238, 052		
1924	917, 806	21, 129. 50	876, 293	51, 668, 117		
1925	999, 006	16, 584. 58	704, 506	[1]46, 166, 627		
1926	930, 464	11, 233. 14	397, 174	[1]31, 413, 715	687	
1927	854, 084	16, 556. 80	393, 533	[1]26, 288, 052		
1928	901, 562	16, 677. 34	413, 326	[1]25, 115, 682	3, 000	
1929	1, 080, 355	20, 041. 03	547, 183	[1]33, 190, 562	12, 686	
1930	857, 786	23, 473. 31	670, 398	[1]27, 249, 516	69, 239	

LEAD ORE

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
1921	3, 947	806. 93	82, 267	34, 853	1, 123, 636	
1922	26, 466	1, 451. 81	263, 681	65, 944	6, 305, 832	
1923	38, 304	1, 654. 38	330, 241	66, 881	9, 510, 172	
1924	16, 536	795. 37	188, 098	78, 354	4, 758, 193	
1925	18, 208	2, 277. 62	174, 494	58, 342	6, 364, 985	27, 238
1926	30, 445	1, 027. 29	128, 027	34, 669	6, 740, 354	
1927	14, 066	330. 46	72, 644	13, 841	2, 290, 862	
1928	3, 401	266. 95	39, 443	20, 950	1, 783, 806	
1929	2, 966	360. 07	60, 641	14, 183	1, 394, 981	
1930	6, 652	496. 42	116, 779	5, 576	3, 471, 936	

ZINC ORE[2]

Year	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
1921	2, 953	50. 99	2, 926	99, 133		846, 184
1922	14, 072	529. 48	15, 390	613, 482		3, 012, 950
1924	9, 000	200. 00	22, 500	360, 000		3, 060, 000
1925	33, 384	180. 02	33, 492	639, 822	4, 072	11, 125, 523
1926	57, 079	950. 99	150, 053	1, 875, 230	6, 695	17, 866, 237
1927	24, 266	335. 68	71, 074	798, 722	1, 780	6, 711, 250

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[1] Includes copper from mine water.

[2] No production reported for 1923 and 1928-1930.

Ore, old tailings, etc., sold or treated in California, 1921–1930, with content in terms of recovered metals—Continued

LEAD-COPPER ORE[3]

Year	Ore, old tailings. etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1922	47	9.95	7,915	4,138	4,294	------------
1923	83	44.87	2,788	7,684	35,090	------------
1926	383	135.60	5,022	22,125	173,207	------------
1927	193	69.08	3,383	13,386	121,867	------------
1928	137	64.65	2,653	9,167	98,911	------------
1929	24	15.15	866	1,661	8,194	------------

LEAD-ZINC ORE[4]

Year	Ore, old tailings. etc.	Gold	Silver	Copper	Lead	Zinc
1925	1,456	2.50	25,926	------------	197,143	336,476
1926	25,162	6.62	70,308	------------	1,167,900	2,567,650
1927	14,679	------------	26,116	------------	296,692	1,351,375

[3] No production reported for 1921, 1924, 1925, and 1930.
[4] No lead-zinc ore, classified as such, in 1921–1924 and 1928–1930.

Ore, old tailings, etc., sold or treated in California in 1930, with content in terms of recovered metals

Source	Ore, old tailings, etc.	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry gold ore	[1] 704,001	247,856.71	101,441	20,923	17,925
Dry silver ore	26,711	3,718.49	721,559	9,257	464
Copper ore	[2] 857,786	23,473.31	670,398	[3] 27,249,516	69,239
Lead ore	6,652	496.42	116,779	5,576	3,471,936
Total, lode mines	1,595,150	275,544.93	1,610,177	[3] 27,285,272	3,559,564
Total, placers	------------	181,655.05	12,626	------------	------------
	1,595,150	457,199.98	1,622,803	[3] 27,285,272	3,559,564
Total, 1929	1,657,069	412,479.25	1,176,895	[4] 33,218,994	1,429,489

[1] Includes 7 tons of old mill cleanings smelted, 13,869 tons of old tailings, etc., cyanided, and 5,500 tons of old tailings concentrated.
[2] Includes 51,157 tons of pyrites roasted for the manufacture of sulphuric acid—residue leached—yielding 41 ounces of silver and 404,007 pounds of copper, and 1,031 tons of old smelter cleanings, slag, and matte resmelted yielding 4,936.00 ounces of gold, 199,186 ounces of silver, 760,656 pounds of copper, and 67,585 pounds of lead.
[3] Includes 242,240 pounds of copper from mine water.
[4] Includes 69,169 pounds of copper from mine water.

Value of metals from ore, old tailings, etc., sold or treated in California in 1930 by classes of ore

Class	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Total value
	Short tons					
Dry gold ore	704,001	$5,123,653	$39,055	$2,720	$896	$5,166,324
Dry silver ore	26,711	76,868	277,800	1,203	23	355,894
Copper ore	857,786	485,236	258,103	[1] 3,542,437	3,462	4,289.238
Lead ore	6,652	10,262	44,960	725	173,597	229,544
	1,595,150	5,696,019	619,918	[1] 3,547,085	177,978	10,041,000
Total, 1929	1,657,069	4,656,096	620,190	[2] 5.846,543	90,058	11,212,887

[1] Includes value ($31,491) of copper from mine water.
[2] Includes value ($12,174) of copper from mine water.

Ore, old tailings, etc., sold or treated in California in 1930, by counties, with content in terms of recovered metals

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
DRY GOLD ORE					
Amador	233, 859	[1] 80, 461. 75	[1] 17, 483		
Butte	1, 096	398. 08	598	353	
Calaveras	[2] 13, 143	3, 678. 98	1, 935	641	113
Eldorado	9, 216	3, 195. 84	584		
Fresno	[3] 1	26. 78	14		
Humboldt	54	34. 71	12		
Inyo	[4] 2, 023	548. 34	232	237	
Kern	[5] 34, 003	7, 895. 36	4, 292		
Lassen	98	142. 53	59		
Madera	64	37. 26	29		
Mariposa	5, 082	[6] 2, 694. 00	[6] 792	104	
Mono	7, 140	1, 263. 80	2, 203		
Nevada	[7] 225, 660	104, 615. 23	60, 379	16, 945	17, 812
Placer	231	171. 91	25		
Plumas	[8] 6, 508	[9] 627. 94	[9] 194		
Riverside	686	233. 18	93	859	
Sacramento	2	39. 07	8		
San Bernardino	[10] 1, 570	774. 41	2, 500	1, 677	
San Diego	367	108. 05	27		
Shasta	[11] 103, 653	8, 059. 05	3, 793		
Sierra	48, 767	26, 964. 00	5, 182		
Siskiyou	1, 619	[12] 1, 369. 22	220		
Trinity	[13] 3, 278	834. 12	226		
Tulare	1	1. 43	1		
Tuolumne	[14] 5, 197	3, 178. 85	528	107	
Ventura	15	10. 68	5		
Yuba	668	492. 14	27		
	704, 001	247, 856. 71	101, 441	20, 923	17, 925
Total, 1929	548, 564	202, 574. 72	73, 593	8, 232	13, 379
DRY SILVER ORE					
Kern	7	1. 01	243		
Mono	1	. 31	123		
Napa	14, 890	1, 767. 22	266, 386	9, 257	464
San Bernardino	11, 813	1, 949. 95	454, 807		
	26, 711	3, 718. 49	721, 559	9, 257	464
Total, 1929	25, 160	2, 247. 68	481, 300	4, 356	249
COPPER ORE					
Alameda	[15] 15, 000		41	84, 812	
Calaveras	37, 340		1, 982	1, 856, 500	1, 184
Humboldt	18		1	1, 919	
Inyo	37	2. 59	81	12, 491	
Mariposa	17		2	3, 616	
Mono	22	4. 94	5, 898	1, 996	
Plumas	695, 189	17, 424. 97	425, 644	19, 529, 224	
Riverside	10	. 60	7	5, 018	
San Bernardino	182	18. 21	1, 762	31, 893	
Shasta	[16] 93, 824	155. 00	9, 982	[17] 3, 962, 383	
Siskiyou	2, 331	209. 00	10, 317	405, 868	470
Trinity	12, 738	702. 00	15, 251	588, 574	
Tuolumne	47	20. 00	244	4, 566	
Undistributed [18]	1, 031	4, 936. 00	199, 186	760, 656	67, 585
	857, 786	23, 473. 31	670, 398	[17] 27,249,516	69, 239
Total, 1929	1, 080, 355	20, 041. 03	547, 183	[19] 33,190,562	12, 686

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[1] Includes small quantity of gold and silver from old mill cleanings cyanided.
[2] Includes 1 ton of old mill cleanings cyanided.
[3] Old mill cleanings cyanided and smelted.
[4] Includes 1,600 tons of old tailings cyanided.
[5] Includes 8,968 tons of old tailings cyanided.
[6] Includes small quantity of gold and silver from old mill cleanings cyanided and smelted.
[7] Includes 5 tons of old mill cleanings smelted.
[8] Includes 5,500 tons of old tailings concentrated.
[9] Includes small quantity of gold and silver from old mill cleanings smelted.
[10] Includes 30 tons of old tailings cyanided.
[11] Includes 1 ton of old mill cleanings smelted.
[12] Includes small quantity of gold from old mill cleanings cyanided.
[13] Includes 2,070 tons of old tailings cyanided.
[14] Includes 1,200 tons of old tailings cyanided.
[15] Pyrites roasted for the manufacture of sulphuric acid—residue leached.
[16] Includes 36,157 tons of pyrites roasted for the manufacture of sulphuric acid—residue leached.
[17] Includes 242,240 pounds of copper from mine water.
[18] Figures represent old smelter cleanings, etc., and metals recovered therefrom (see Contra Costa County, p. 989).
[19] Includes 69,169 pounds of copper from mine water.

Ore, old tailings, etc., sold or treated in California in 1930, by counties, with content in terms of recovered metals—Continued

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Inyo	6, 495	435. 03	111, 272	5, 019	3, 421, 668
Madera	5	2. 78	151	98	4, 993
San Bernardino	151	58. 29	4, 549	459	44, 958
Tulare	1	. 32	807	------------	317
	6, 652	496. 42	116, 779	5, 576	3, 471, 936
Total, 1929	2, 966	360. 07	60, 641	14, 183	1, 394, 981

METALLURGIC INDUSTRY

Fifty-three per cent of the ore from California mines was concentrated, 34 per cent was treated by amalgamation, and 7 per cent was treated by cyanidation; the quantity of ore shipped crude to smelters and old tailings and miscellaneous material treated was negligible. The bulk of the concentrates, as well as considerable first-class shipping ore, was sent to Utah smelters. The milling practice in California has improved during the past year, especially the development of flotation at several gold and silver mills, and has been responsible for a greater saving of metal. The Selby smelter of the American Smelting & Refining Co. continued to receive most of the gold and silver ore, crude lead ore and concentrates, gold and silver bullion from Arizona, California, Nevada, and Oregon mines, and much foreign material. The plant of The Mountain Copper Co. (Ltd.) at Martinez, Contra Costa County, handled only ore from its Shasta County mine.

In 1930 ore, old tailings, etc., from California mining operations amounted to 1,595,150 tons, of which 28,804 tons were ore shipped crude to smelters, 654,164 tons were ore treated at amalgamation and cyanidation mills with or without supplementary concentration, and 846,118 tons were ore and old tailings treated in mills equipped for concentration only. Of the 654,164 tons of ore sent to amalgamation and cyanidation mills 330,110 tons were treated by amalgamation followed by concentration, so that the total ore and old tailings concentrated amounted to 1,176,228 tons, or 74 per cent of the total ore, old tailings, etc., treated. The 28,804 tons of crude ore shipped to smelters were classified as follows: Dry gold ore, 1,261 tons; dry silver ore, 2,055 tons; copper ore, 19,236 tons; and lead ore, 6,252 tons. The 674,894 tons of ore, concentrates, and old tailings treated at amalgamation and cyanidation mills were classified as dry gold material. Of the total material treated by amalgamation and cyanidation, 543,750 tons were ore amalgamated, 124,283 tons were ore and old tailings directly cyanided, and 6,861 tons were concentrates cyanided. The 1,176,228 tons of ore and old tailings concentrated (including 330,110 tons first treated by amalgamation) were classified as follows: Dry gold ore and old tailings, 364,810 tons; dry silver ore, 24,656 tons; copper ore, 786,362 tons; and lead ore, 400 tons. Of the total ore concentrated, 840,618 tons were reduced at flotation plants and classified as follows: Dry gold ore, 29,200 tons; dry silver ore, 24,656 tons; copper ore, 786,362 tons; and lead ore, 400 tons. The ore reduced at flotation plants yielded 54,071 tons of concentrates, classified as follows: Dry gold concentrates, 615 tons; silver concentrates, 1,483 tons; copper concentrates, 51,886 tons; and lead concentrates, 87 tons.

The miscellaneous material, other than ore and old tailings milled and ore smelted, consisted of 1,038 tons of old mill and smelter cleanings, slag, and matte resmelted; 51,157 tons of pyrites roasted for the manufacture of sulphuric acid; and mine-water precipitates. The sinter resulting from the roasting of pyrites was leached and yielded 404,007 pounds of copper.

The following table lists the important mills that were active in 1930.

Large mills in California active in 1930

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Class of ore treated	Product
			Short tons per day		
Amador Metals Reduction Co. (custom mill).	Jackson	Cyanidation	300	Gold	Gold bullion.
American Foundation Co. (Murchie mine).	Nevada City	Flotation	200	do	Gold concentrates.
Argonaut Mining Co	Jackson	Amalgamation, gravity concentration.	260	do	Gold bullion, gold concentrates.
Banner Development Co. (Palisade mine).	Calistoga	Flotation	100	Silver	Silver concentrates.
Central Eureka Mining Co.	Sutter Creek	Amalgamation, gravity concentration.	150	Gold	Gold bullion, gold concentrates.
Empire Star Mines Co. (Ltd.):					
Empire mill	Grass Valley	do	400	do	Do.
North Star mill	do	Amalgamation, gravity, flotation.	300	do	Do.
Engels Copper Mining Co.:					
Calaveras mill	Copperopolis	Flotation	500	Copper	Copper concentrates.
Superior mill	Engelmine	do	1,500	do	Do.
Engineers Exploration Co. (Ophir mine)	Trona	Gravity concentration.	100	Lead	Lead concentrates.
Idaho Maryland Mines Co.	Grass Valley	Amalgamation, gravity concentration.	60	Gold	Gold bullion, gold concentrates.
Kennedy Mining & Milling Co.	Martell	do	250	do	Do.
The Mountain Copper Co. (Ltd.):					
Iron Mountain	Matheson	Cyanidation	550	do	Gold bullion.
Do	do	Flotation	350	Copper	Copper concentrates.
Original Sixteen to One Mines (Inc.):					
Sixteen to One mill	Alleghany	Amalgamation, gravity concentration.	100	Gold	Gold bullion, gold concentrates, pan tailings.
Tightner mill	do	do	90	do	Do.

Large mills in California active in 1930—Continued

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Class of ore treated	Product
			Short tons per day		
Treadwell Yukon Co. (Ltd.):					
Red Cloud mill	Bodie	Amalgamation, gravity concentration.	60	Gold	Gold bullion, gold concentrates.
Standard mill	do	Amalgamation, gravity, flotation.	125	do	Do.
Walker Mining Co.	Walkermine	Flotation	1,700	Copper	Copper concentrates.
Wortley Consolidated Mines (Inc.) (Uranium mine).	Red Mountain.	do	400	Silver	Silver concentrates.
Yellow Aster Mining & Milling Co.	Randsburg	Amalgamation	100	Gold	Gold bullion.

One hundred and sixty-eight milling plants of various kinds, not including 86 or more hand mortars and arrastres, treated ore and old tailings in California in 1930. Of the 168 milling plants 83 used amalgamation alone, 54 amalgamation and gravity concentration, 12 concentration only (11 flotation and 1 gravity), 12 cyanidation (2 treating custom ore), 3 amalgamation and cyanidation, 1 concentration and cyanidation, and 1 amalgamation, concentration, and cyanidation; and 2 were copper leaching plants. Cyanide consumption in California amounted to 102,909 pounds, of which 51,600 pounds were potassium cyanide, 12,890 pounds sodium cyanide, and 38,419 pounds cyanamid. The inquiry for quantity of mercury (quicksilver) purchased in 1930 brought responses from gold producers operating placers and lode mines, reporting 10,068 pounds of mercury purchased and 6,369 pounds in stock at the close of the year.

Mine production of metals in California in 1930, by methods of recovery

Method of recovery	Material treated	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ore amalgamated	543, 750	173, 514. 64	42, 287		
Ore, old tailings, etc., cyanided	124, 283	9, 577. 28	6, 034		
Concentrates cyanided [1]	6, 861	33, 534. 99	10, 222		
Ore smelted	28, 804	4, 183. 82	396, 441	1, 726, 807	3, 412, 843
Concentrates smelted:					
Flotation	54, 071	30, 621. 09	948, 005	24, 151, 209	74, 104
Table	1, 349	8, 895. 58	6, 010	353	5, 032
Pyrites roasted for acid—residue leached	[2] 51, 157		41	[3] 646, 247	
Miscellaneous material (old mill and smelter cleanings, etc.) smelted	1, 038	5, 116. 58	199, 299	760, 656	67, 585
Bullion from placer mining		181, 655. 05	12, 626		
Bullion from pocket mining		10, 100. 95	1, 838		
		457, 199. 98	1, 622, 803	[3] 27, 285, 272	3, 559, 564
Total, 1929		[4] 412, 479. 25	[4] 1, 176, 895	[5] 33, 218, 994	1, 429, 489

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[1] Concentrates cyanided came from 330,110 tons of ore first amalgamated.

[2] Residue leached amounted to 33,389 tons.

[3] Includes 242,240 pounds of copper from mine water.

[4] Includes gold and silver from pocket mining as follows: 10,585.04 ounces of gold and 1,923 ounces of silver.

[5] Includes 69,169 pounds of copper from mine water.

Mine production of metals from gold and silver mills in California in 1930, by counties

County	Ore, old tailings, etc., treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings, etc.	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Amador	233, 849		64, 040. 42	12, 917	30. 06	8
Butte	1, 076		182. 64	35	85. 70	138
Calaveras	9, 408	1	2, 170. 68	631	114. 49	11
Eldorado	9, 216		2, 695. 65	445	5. 73	
Fresno					20. 11	8
Humboldt	54		34. 71	12		
Inyo	401	1, 600	118. 84	76	342. 58	78
Kern	24, 862	8, 968	6, 483. 62	1, 918	1, 041. 46	1, 659
Lassen	96		135. 94	50	2. 40	5
Madera	62		31. 73	24		
Mariposa	5, 079		2, 590. 82	538	7. 21	2
Mono	4, 924		835. 53	526	109. 84	221
Nevada	202, 302		70, 673. 51	20, 934	65. 37	24
Placer	231		171. 91	25		
Plumas	981		420. 86	113		
Riverside	660		183. 22	39		
Sacramento	2		39. 07	8		
San Bernardino	715	30	188. 41	55	52. 69	78
San Diego	367		108. 05	27		
Shasta	103, 649		831. 53	146	7, 210. 78	3, 636
Sierra	48, 747		26, 446. 88	4, 847		
Siskiyou	1, 612		1, 341. 33	212	1. 92	
Trinity	1, 202	2, 070	591. 35	154	189. 65	56
Tuolumne	3, 986	1, 200	2, 796. 07	361	297. 29	110
Ventura	15		10. 68	5		
Yuba	668		492. 14	27		
	654, 164	13, 869	[1] 183, 615. 59	[1] 44, 125	9, 577. 28	6, 034
Total, 1929	505, 471	28, 468	[1] 160, 052. 89	[1] 40, 061	19, 042. 37	7, 077

County	Concentrates and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	4, 184	16, 234. 82	4, 501		
Butte	12	107. 12	232	353	
Calaveras	167	495. 51	169		
Eldorado	189	494. 46	139		
Inyo	2	12. 90	7		
Kern	9	55. 06	79		
Mariposa	21	78. 55	89		
Nevada	3, 498	24, 367. 93	10, 759		5, 032
Sierra	66	381. 43	181		
Trinity	5	32. 32	10		
Tuolumne	7	29. 37	19		
	8, 160	42, 289. 47	16, 185	353	5, 032
Total, 1929	4, 771	16, 802. 44	7, 418		9, 351

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[1] Includes gold and silver from pocket mining as follows: 1930, 10,100.95 ounces of gold and 1,838 ounces of silver; 1929, 10,585.04 ounces of gold and 1.923 ounces of silver; quantity of ore not recorded.

Mine production of metals from concentrating mills in California in 1930, by counties

County	Ore and old tailings to concentrating mills		Concentrates and recovered metal				
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Calaveras	41, 056		5. 255	835. 72	3, 073	1. 857, 141	1, 297
Inyo	400		87	. 87	391		59, 563
Mono	2, 216		13	318. 43	1, 456		
Napa	14, 890		416	1, 767. 22	266, 386	9, 257	464
Nevada	23, 268		584	9, 098. 12	28, 426	16, 945	12, 780
Plumas	695. 189	5, 500	40, 822	17, 566. 07	425, 691	19, 529, 224	
San Bernardino	9, 766		1. 067	1, 175. 76	220, 169		
Shasta	53, 833		5, 877		2, 460	2. 738, 642	
	840, 618	5, 500	54, 121	30, 762. 19	948, 052	24. 151, 209	74, 104
Total, 1929	993, 387		64, 356	24, 641. 54	774, 933	29, 002, 142	49, 239

Gross metal content of California concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates (dry weight)	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry gold	8, 825	52, 682. 84	47, 205	25, 632	18, 754
Dry silver	1, 483	2, 942. 98	486, 555	13, 224	488
Copper	51, 886	17, 424. 97	430, 086	24, 870, 479	1, 973
Lead	87	. 87	391		62, 698
	62, 281	73, 051. 66	964, 237	24, 909, 335	83, 913
Total, 1929	69, 127	41, 443. 98	782, 351	30, 213, 667	66, 579

Mine production of metals from California concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	4, 184	16, 234. 82	4, 501		
Butte	12	107. 12	232	353	
Calaveras	5, 422	1, 331. 23	3, 242	1, 857, 141	1, 297
Eldorado	189	494. 46	139		
Inyo	89	13. 77	398		59, 563
Kern	9	55. 06	79		
Mariposa	21	78. 55	89		
Mono	13	318. 43	1, 456		
Napa	416	1, 767. 22	266, 386	9, 257	464
Nevada	4, 082	33, 466. 05	39, 185	16, 945	17, 812
Plumas	40, 822	17, 566. 07	425, 691	19, 529. 224	
San Bernardino	1, 067	1, 175. 76	220, 169		
Shasta	5, 877		2, 460	2, 738, 642	
Sierra	66	381. 43	181		
Trinity	5	32. 32	10		
Tuolumne	7	29. 37	19		
	62, 281	73, 051. 66	964, 237	24, 151, 562	79, 136
Total, 1929	69, 127	41, 443. 98	782, 351	29, 002, 142	58, 590

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead
Dry gold	8, 825	52, 682. 84	47, 205	17, 939	17, 925
Dry silver	1, 483	2, 942. 98	486, 555	9, 257	464
Copper	51, 886	17, 424. 97	430, 086	24, 124, 366	1, 184
Lead	87	. 87	391		59, 563
	62, 281	73, 051. 66	964, 237	24, 151, 562	79, 136

Gross metal content of California crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Ore (dry weight)	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Gold	1,261	1,800.42	3,964	3,195	
Silver	2,055	775.51	235,004		
Copper	19,236	1,112.34	41,085	1,772,400	783
Lead	6,252	495.55	116,388	8,002	3,591,797
	28,804	4,183.82	396,441	1,783,597	3,592,580
Total, 1929	41,386	4,433.13	332,931	3,695,581	1,407,790

Mine production of metals from California crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	10	156.45	57		
Butte	20	22.62	193		
Calaveras	18	62.58	33		
Humboldt	18		1	1,919	
Inyo	6,154	510.77	111,033	17,747	3,362,105
Kern	180	316.23	879		
Lassen	2	4.19	4		
Madera	7	8.31	156	98	4,993
Mariposa	20	10.91	163	3,720	
Mono	23	5.25	6,021	1,996	
Nevada	85	255.55	140		
Plumas	27	56.50	29		
Riverside	36	50.56	61	5,877	
San Bernardino	3,205	1,384.00	243,316	34,029	44,958
Shasta	3,837	168.57	7,529	662,306	
Sierra	20	135.69	154		
Siskiyou	2,338	234.97	10,325	405,868	470
Trinity	12,744	722.80	15,257	588,574	
Tulare	2	1.75	808		317
Tuolumne	58	76.12	282	4,673	
	28,804	4,183.82	396,441	1,726,807	3,412,843
Total, 1929	41,386	4,433.13	332,931	3,551,626	1,370,899

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry gold	1,261	1,800.42	3,964	2,984	
Dry silver	2,055	775.51	235,004		
Copper	19,236	1,112.34	41,085	1,718,247	470
Lead	6,252	495.55	116,388	5,576	3,412,373
	28,804	4,183.82	396,441	1,726,807	3,412,843

REVIEW BY COUNTIES AND DISTRICTS

ALAMEDA COUNTY

The value of the production of metals (copper and silver) in Alameda County decreased from $17,696 in 1929 to $11,042 in 1930, as a result of decreased output and lower prices of both metals.

Alma district.—The Leona Chemical Co. operated its pyrites mine, opened by a tunnel 800 feet long, and produced about 11,000 tons of pyrites. This ore was crushed at the mine to pass a ⅜-inch mesh screen and shipped to the Stege plant of the Stauffer Chemical Co., where it was roasted for the manufacture of acid. The roasted ore contained some copper and silver recovered in a leaching plant at Stege.

AMADOR COUNTY

The value of the production of metals in Amador County increased from $1,611,253 in 1929 to $1,847,291 in 1930, due to the increased output of gold in the Jackson district. The county ranked second in the State in 1930 in gold produced. The Kennedy was the largest producer of gold in the county, followed by the Argonaut and Central Eureka.

Jackson and Sutter Creek districts.—Thirteen lode-mine producers and three placers, all in the vicinity of Jackson, Martell, Plymouth, and Sutter Creek, reported 233,708 tons of ore, $1,659,803 in gold, and 17,412 ounces of silver, valued together at $1,666,507. The ore averaged $7.13 to the ton in gold and silver. Most of the ore was treated in stamp mills by amalgamation, gravity concentration, and cyanidation; only 6 tons were first-class smelting ore. Sulphide concentrates reground and treated by cyanidation amounted to 3,563 tons and concentrates smelted to 619 tons. Three companies operating lode mines—the Kennedy, Argonaut, and Central Eureka—produced metals representing 97 per cent of the total value of the region; in output of gold in the State these companies ranked fourth, fifth, and seventh, respectively. The 260-ton stamp amalgamation-concentration plant of the Argonaut Mining Co. was operated the entire year. About 90,000 tons of ore were crushed, from which an average of about 69 per cent of the gold was caught in the batteries and on the plates, the concentrates accounting for an additional 18 per cent. The concentrates are composed of auriferous pyrite, with small amounts of galena, sphalerite, chalcopyrite, tetrahedrite, pyrrhotite, and arsenopyrite. The loss of gold in the sands and slimes amounts to 13 per cent, half of which is free gold contained in the carbonaceous or graphitic slimes. The treatment of these slimes and the mining and milling methods used at the Argonaut property are described in various publications of the Bureau of Mines.[7] The Argonaut mine is opened by a 70° inclined 3-compartment shaft 5,800 feet in the country rock, in the hanging wall of the vein. Rather low-grade ore was mined for several years prior to 1930, when development of the lower levels revealed very rich bodies of milling ore. The gold output of the Kennedy mine was increased over that of the previous year, although only 60 stamps of its 100-stamp amalgamation-gravity concentration mill were used. Gold bullion and concentrates were shipped to the Selby smelter. The mine is opened by a shaft sunk vertically a depth of 4,650 feet, from which an incline was extended in 1930 to the 4,800-foot level.

According to the annual report[8] of the company, development of the Central Eureka mine at Sutter Creek was partly discontinued, due to the cost of mining low-grade ore in heavy ground at a depth of 4,800 feet. All equipment was moved to the 3,800-foot level; and work was directed toward opening the Old Eureka mine 1,500 feet distant with a drift started in September from the 2,500-foot level. Both mines were producing while development was going on, and the 40-stamp amalgamation-gravity concentration mill, which operated 320 days, treated 54,026 tons of ore. Gold and silver bullion, amounting to 13,575 ounces and valued at $231,663, or $17.06 an ounce, was produced. Sulphide concentrates, amounting to 1,278 tons and valued at $99,027, or $77.46 a ton, were sold to a local custom cyanide plant. The average assay of the total ore milled was $6.90 a ton, of which 88.7 per cent was saved. The mill tailings assayed 78 cents a ton. Of the ore mined 18,753 tons came from the stopes on the 4,700 and 4,800 foot levels of the Central Eureka mine, and 35,348 tons came from the 2,000 and 2,100 foot levels of the Old Eureka mine. A lessee treated the Central Eureka tailings by cyanidation. At Drytown the gold produced during the past five years from the Silver Dime property was sold in 1930. An incline shaft sunk 70 feet is in ore, which is sorted and from which the gold is recovered with a hand mortar. The Wildcat placer, a drift mine near Jackson, and the 49 Flat gravel mine at Sutter Creek produced a little placer gold, 0.904 and 0.889 fine, respectively.

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[7] Leaver, E. S., and Woolf, J. A., Re-Treatment of Mother Lode (California) Carbonaceous Slime Tailings: Tech. Paper 481, Bureau of Mines, 1930, 20 pp.
Vanderburg, W. O., Mining Methods and Costs at the Argonaut Mine, Amador County, Calif.: Inf. Circ. 6311, Bureau of Mines, 1930, 15 pp.
Woodworth, S. E., Milling Methods and Costs at the Argonaut Mill, Jackson, Calif: Inf. Circ. 6476, Bureau of Mines, 1931, 9 pp.

[8] Central Eureka Mining Co. Annual Report for year ended Apr. 23, 1931.

Pioneer district.—Seven lode claims in the Pioneer district produced 151 tons of ore yielding $4,190 in gold and 76 ounces of silver, valued together at $4,219. All the output was treated in stamp mills with amalgamation and gravity concentration equipment. The Carrie mine, the principal producer in the district, is opened by a 100-foot vertical shaft and 500 feet of drifts. It has a 5-stamp pilot mill and a Deister-Overstrom table. The plant was used part of 1930 for treatment of custom ores. Other producers were the Coeur Leonis, Golden Thread, and Pioneer. The Pioneer is opened by a 1,100-foot tunnel and a 65-foot shaft.

Volcano district.—Lagomarsino Brothers hydraulicked about 6,000 cubic yards of gravel from the Elephant or Union Flat property. The gold recovered was 0.899 fine.

BUTTE COUNTY

The value of the metals produced in Butte County in 1930 was $127,326, compared with $72,092 in 1929. This large increase reflects the increased number of small operators in 1930 working the open ground, bars, and creeks comprising the drainage area of the Middle and North Forks of the Feather River. To quote from the 1930 report of the State mineralogist:[9]

> The drift mines which were opened after the exhaustion of the surface placers have proved to be mostly on small channels, but a few of them * * * were rich producers over a long period of years. In the main, however, these mines give employment to only a few men each. The principal drift mining section is bounded on the east by the West Branch of Feather River, on the west by Big Chico Creek, and extends from the vicinity of Centerville and Paradise on the south, in a direction a little east of north to the top of the mountain divide in the northeast corner of the county, where the waters of the West Branch are separated from those of the North Fork of Feather River by summits about 6,600 feet high. The streams in this section flow south and southwest, cutting the lava-covered slope into a series of long ridges beneath which are found a multitude of steep, narrow gold-bearing ancient stream channels.

Butte Creek district.—Since 1928 the Johnston Rock Co. has operated a 1,000-ton rock crusher plant on Butte Creek near Chico.

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[9] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 383.

Some gold was recovered from the material handled during the use of a Sauermann dragline rig which was abandoned after the completion of a new 1,500-ton plant.

Cherokee district.—Three placers in the Cherokee district produced $2,214 in gold and 11 ounces of silver, valued together at $2,218. The metals came principally from the Cherokee mine and the Lyte placer on Dry Creek. Both placers have been producing for many years.[10]

Concow district (*Berry Creek*, *Lumpkin*, *Yankee Hill*).—Four placers and five lode claims in the Concow district produced 672 tons of ore, $6,230 in gold, 387 ounces of silver, and 353 pounds of copper, valued in all at $6,425. The Jennie May mine at Berry Creek was under development, and about 30 tons of gold ore was milled. Placer gold from the Golden Reef claim at Berry Creek was recovered by sluicing. A little gold was produced by lessees at the Triumph mine from ore mined from a vein developed between the Nos. 2 and 3 adits. The amalgamation mill, completed in 1928 with five 1,250-pound stamps, was operated. Near Yankee Hill the Surcease mine produced 600 tons of milling ore, from which bullion and gold concentrates were shipped to a smelter and tailings and some concentrates were treated by cyanidation. Specimen gold was recovered from thin blanket quartz seams occurring in various properties in the region. The Gold Pan placer at Lumpkin was prospected in 1930. This property is equipped with a small dredge, which has been working the Kanaka Bar on the Middle Fork of the Feather River.

Feather River district.—In the vicinity of Bangor merchants purchased gold dust amounting to $1,162 in gold and silver from eight prospectors.

Magalia district (*Coutolenc*, *De Sabla*, *Nimshew*).—Twenty-six placers and five lode producers in the Magalia district reported 104 tons of ore, $10,590 in gold, and 80 ounces of silver, valued together at $10,621. The El Monte mine at De Sabla was the chief producer of lode gold in the district. The gold was recovered in a Huntington mill by amalgamation. Other lode producers were the Gold Mountain, Rich Ore, and Springer properties. Work was discontinued in 1930 at the Genii drift placer near Magalia until an adequate conveying system could be installed to prevent débris from entering the West Branch of the Feather River. Since March, 1928, the property has been under development, and a 3,500-foot adit was driven under 700 feet of lava capping to explore the Mammoth channel. Rich gravel was found, and about 500 yards were tested and yielded $2,577. The bullion, 0.869 in gold fineness and 0.107 in silver fineness, was on exhibit at the office of the operating company. The property is described in the 1930 report of the State mineralogist.[11] The placers of the Magalia district produced $8,854 in gold and 65 ounces of silver, valued together at $8,879, most of which came from the Lucky John, Oro Fino, Dix Butte, and Aladdin properties. The Lucky John mine on the Mammoth channel was worked between February and September, and in addition to the gold sold to the mint some black sand containing gold was sold to a custom plant at Coutolene. The Emma drift mine on the east side of Big Butte Creek near Nimshew and the Oro Fino drift placer on Indian Springs Ravine near De Sabla are included in the 26 placers listed for the district. At the Oro Fino property, 1,500 cubic yards of gravel were worked over during the last six months of the year. The gold produced had a fineness of 0.873.

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[10] State Mineralogist, Twenty-sixth Annual Report: 1930, pp. 387–389.
[11] State Mineralogist, Twenty-sixth Annual Report: 1930, pp. 392–393.

Merrimac district.—At Isaiah the Rim Rock and Wildcat placers have produced some gold regularly each year. Both properties are drift mines, and the gold recovered averaged about 0.774 fine.

Oroville district.—The Shasta Butte Gold Dredging Co., the Banner lode, and 32 placer prospects in the Oroville district produced $105,349 in gold and 596 ounces of silver. All the placer output was from properties on the Feather River. The Shasta Butte dredge, a 73-bucket electrically driven boat situated near Haselbusch 8 miles southwest of Oroville, was operated the entire year. It is the only dredge in the county and has been the principal producer of gold with some platinum metals each year since 1928, when operations began; it handled about 1,680,000 cubic yards of gravel in 1930. This company also operated a dredge on Clear Creek in the Horsetown district in Shasta County. The Banner lode 4 miles east of Oroville was under development and produced about 300 tons of ore, part of which was treated in an amalgamation mill; about 20 tons of gold ore were shipped to a smelter.

CALAVERAS COUNTY

The value of the metals produced in Calaveras County increased from $317,386 in 1929 to $355,961 in 1930, with the principal increase in the quantity and value of copper. The increase in the output of gold was due partly to the numerous small lode producers and pocket hunters in the county.

Angels district (*Vallecito*).—Six lode mines and four placers in the Angels district produced 572 tons of ore, $8,088 in gold, and 61 ounces of silver, valued together at $8,112. The most important developments were at the Osborn mine, which is equipped with a 20-stamp amalgamation-concentration mill. The mine is opened by three incline shafts 200, 170, and 65 feet deep and a 500-foot tunnel with 500 feet of drifts. A large part of the production was cleanings from old mills and arrastres. Some ore was hauled from the Shot Gun mine dumps and concentrated at the Demarest mill. The placers of the district produced $4,711 in gold and 32 ounces of silver, valued together at $4,724. The Calaveras Central Mining Corporation developed a drift placer on the Central Hill Channel with a 350-foot shaft. The Calmo placer north of Angels Camp produced some gold taken out during development work. The Douglas Flat Mining Co. operated a trommel of 240 tons daily capacity on gravel from its drift mine on Coyote Creek near Vallecito.

Campo Seco district (*Valley Springs*).—Gold ore from the Ludwig and Oneto properties was treated in a hand mortar, and one small lot of ore was shipped to a smelter. Some copper concentrate left over from the operations of the 100-ton flotation mill of the Mateo Mining Co. was shipped to the smelter. The company was recently disincorporated. A lessee sold a little placer gold and some pocket gold produced prior to 1930 from the Lemon Ranch property.

Copperopolis district.—Three lode mines in the Copperopolis district produced 38,940 tons of ore yielding $4,173 in gold, 2,142 ounces of silver, 1,840,321 pounds of copper, and 1,184 pounds of lead, valued in all at $244,299. Of the ore mined 37,340 tons were of milling grade and yielded 5,216 tons of copper concentrates, and 1,600 tons were treated at gold and silver mills and yielded gold and silver by amalgamation. The principal production was from the Calaveras Copper Co. property controlled by the Engels Copper Mining Co. The mine and a 500-ton flotation mill were operated until June 1, when the property was closed indefinitely. Development in 1930 consisted of deepening the vertical shaft 118 feet, 2,601 feet of drifts, 1,247 feet of crosscuts, and 341 feet of raises. The company report[12] says:

> All property formerly owned by Calaveras Copper Co. at Copperopolis was transferred to the Calaveras Consolidated Mining Co. (Ltd.), incorporated under the laws of Nevada, February 5, 1931. Forty-nine per cent of the stock in the new company is to be issued in payment for the property, and 51 per cent is taken over by the Engels Copper Mining Co. * * * Development and exploration was vigorously carried on at Copperopolis during the early part of the year. After the slump in the copper price, all exploration and development was stopped in July, 1930. At present, and until improvement in the copper situation, only pumping and necessary work of maintaining the property in first-class condition is carried on. During the year, 6,502 feet of drifts, shafts, crosscuts, and raises were driven. Also, five diamond drill holes were drilled. The most encouraging results from this work were in the Keystone shaft workings, on the 675-foot level. Ore averaging better than 5 per cent for a width of 10 feet was exposed for a length of 15 feet, when work was stopped. It is expected that this ore shoot will continue for some distance and prove a profitable ore body.
>
> The flotation mill was operated 154 days during the year and treated 37,570 tons of ore, assaying an average of 2.45 per cent copper; 9,270,372 pounds of concentrate was produced, from which was obtained 1,679,645 pounds of copper. On account of the great amount of exploration work and developing carried on, the operations, after these charges, show a loss.
>
> New flotation machines were installed shortly before closing down. During the short time they were operated they showed improved recovery and produced a better grade of concentrate than the old equipment. The Keystone shaft was equipped with a new hoist, headframe, ore bins, and two self-dumping skips.

The Gold Knoll property was furnished in 1930 with electric power to operate the mine and mill. The mill has 10 stamps and a concentrating table and was operated about a month. Gold bullion and concentrates were shipped to the mint and the Selby smelter. At the Harmon property about 100 tons of ore were produced; it was treated in a 5-stamp amalgamation-concentration mill on the Mountain King mine at Hodson.

Eldorado district.—At the head of the North Fork of Willow Creek near San Andreas the La Chapelle placer produced some gold, and at Mountain Ranch the Vandalia placer was productive.

Esmeralda and Murphys district.—Two lode mines in the Esmeralda and Murphys district produced 3,729 tons of ore yielding $18,341 in gold, 1,093 ounces of silver, 641 pounds of copper, and 113 pounds of lead, valued in all at $18,851, or an average of $5.06 in metals a ton. Nearly all the ore was from the Oro y Plata mine, operated by the Union Consolidated Mining Co. The mine is opened by a 300-foot vertical shaft and 1,100 feet of drifts. About 320 feet of development work were done in 1930. The mill, equipped for flotation, was operated the greater part of the year. Many small lots of gold were taken in trade or purchased by merchants in the district.

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[12] Engels Copper Mining Co., Seventeenth Annual Report, for year ended Dec. 31, 1930.

Jenny Lind district.—Two lode mines and three placers in the Jenny Lind district produced 2,734 tons of ore, $35,073 in gold, and 288 ounces of silver, valued together at $35,184. The larger part of the ore was produced from the McCarty Ranch at Milton; it was ground in a 20-ton Rexman Forrester rod mill in which the rods were substituted for balls. The mill is equipped for amalgamation and concentration of the ore by Frue vanners. The property is developed through incline shafts 240 and 110 feet deep. At the Morning Star mine, which is opened by a shaft 200 feet deep, siliceous gold ore was produced and treated in a 4-stamp amalgamation mill. The owners are adding some new mill equipment each year. The Milton Mining Co. operated a 50-bucket electric dredge on South Gulch and handled approximately 3,000 cubic yards of gravel between March and December. Some placer gold was also produced in sluicing on the Calaveras River about 4 miles from Valley Springs.

Melones district (*Carson Hill*).—Small lots of bullion were purchased by storekeepers who reported having purchased gold from miners and prospectors in the Melones district.

Mokelumne Hill district.—About 400 tons of ore taken from the 180-foot level of the Lamphear mine were treated in the 20-stamp amalgamation mill on the property; altogether about $4,000 in gold was produced before the company closed the mine on account of financial difficulties. The Salvador mine, developed by two tunnels 1,070 and 300 feet long, is equipped with an 8-stamp amalgamation mill. The mine was idle, but some mill cleanings yielded gold bullion. Six drift placers in the Mokelumne Hill district produced $2,094 in gold and 12 ounces of silver, valued together at $2,099. The output was about equally divided among the producers. The Boundary Cone, Buffalo, Green Mountain, and Nuner were the principal placers operated.

San Andreas district.—Prospecting in the vicinity of San Andreas resulted in the production of some gold bullion from specimen ore found in the Coarse Gold mine and its extension east of the Mother Lode. The gold was 0.922 fine. About $100 in specimen gold was taken from the Little Kennedy, a pocket mine at San Antone. Three placers produced $410 in gold and 2 ounces of silver from sluicing operations on the Calaveras River and Latimer Gulch.

Sheepranch or Washington district.—Four placers and three lode mines produced 3,425 tons of ore, $26,418 in gold, and 211 ounces of silver, valued together at $26,499. The old Calaveras mine at Sheepranch, developed by a vertical shaft 350 feet deep and 1,050 feet of drifts, was the principal producer. Development in 1930 consisted of 500 feet of drifts and 430 feet of crosscuts. The property is equipped with a 10-stamp amalgamation and concentration mill, to which was added one K K flotation machine. The flotation unit replaced two Frue vanners. The ore is crushed to 2½-inch mesh, stamped to 35-mesh, and amalgamated in batteries and on plates, followed by coarse concentration on tables and fine concentration of table tails (rejects) in the flotation plant. Part of the concentrates were shipped to a smelter, and part were treated by cyanidation. Small lots of bullion were shipped from pocket mines by numerous prospectors. The four placers produced $1,355 in gold and 3 ounces of silver. The largest placer production came from the Moss placer 5 miles from Mountain Ranch on the Sheepranch road. Gold was taken also from the Gaston Hill and Humboldt claims and from the Warren Creek placers.

Valley Springs district.—Some gold from the Valley Springs district was sold to the mint.

Westpoint district.—Three placers and six lode mines in the Westpoint district produced 674 tons of ore, $5,738 in gold, and 109 ounces of silver, valued together at $5,780. Most of the ore was of milling grade and was treated in a custom amalgamation mill in the adjoining Pioneer district, producing bullion and sulphide concentrates. Concentrates and some crude ore were shipped to the Selby smelter from the Enterprise mine, opened by an incline shaft 155 feet deep. Sulphide ore was produced from the Woodhouse mine and treated in the 100-ton amalgamation-concentration mill on the property. The Yellow Aster mine was opened with 300 feet of new tunnel work in 1930 and produced a little ore from which gold 0.767 fine was recovered in a 3-stamp amalgamation mill.

CONTRA COSTA COUNTY

Although there are no metal-producing mines in Contra Costa County it has been a metallurgical center for many years, and left-over residues and smelter material of abandoned reduction plants are marketed when metal prices are favorable. No distribution, by producing counties, has been attempted for the metal from such material sold in 1930 and credited to Contra Costa County by the smelter.

The copper-smelting plant of The Mountain Copper Co. (Ltd.) at Martinez has in the past smelted considerable custom ore, but all the ore treated at present comes from the Iron Mountain mine in Shasta County; the company's activities are now devoted to the manufacture of sulphuric acid, fertilizers, gas purifiers, and blue vitriol. The Selby lead smelter and refinery of the American Smelting & Refining Co. purchase ore and refine lead and gold and silver bullion from various Western States. In 1919 the Butters Electrolytic Zinc Syndicate, now inactive, began testing copper ore and concentrates, containing zinc, from Shasta County at a plant 2 miles east of Martinez. Copper was precipitated from the solution, and metallic zinc was obtained by electrolysis. In 1923 the plant was used by the Arsenic Products & Refining Co. for the manufacture of crude arsenic, but such manufacture was discontinued the following year; the ores treated for their arsenic content came from several Western States. At one time the Great Western Electro Chemical Co. operated a large chemical plant 1 mile east of Pittsburg and experimented with zinc concentrates from Utah, making zinc chloride and returning the residue to Utah smelters.

DEL NORTE COUNTY

Since 1851 beach mining has been more or less active along the Pacific coast. The first record of beach mining was that at Gold

Bluff, Humboldt County, Calif.; later such operations extended as far north as Coos Bay, Oreg. Ancient beach lines extend inland 1 to 5 miles from the present beach at various points. The search for gold, with many processes and machines used for its recovery, continues; but the output of metal has been small. So far, the most successful method of recovery is the so-called Chinese table covered with burlap or matting. This table set at a slight inclination, with a well-regulated flow of water, is quite effective. Beach mining of small concentrated lenses of black sand 2 miles south of Crescent City in Del Norte County received attention late in 1930; some gold, with metals of the platinum group, was shipped to eastern refiners.

The Kaus placer on Craigh Creek yielded a little gold 0.927 fine. On Myrtle Creek the placer operated by Dan London, which has been a regular producer for a number of years, produced gold 0.934 fine.

ELDORADO COUNTY

The value of the gold and silver produced in Eldorado County in 1930 was $78,269, compared with $57,916 in 1929; the value was almost entirely in gold. The number of small gold operations in the county increased over 1929.

Eldorado district.—Three placers and four lode mines in the Eldorado district produced 19 tons of ore, $2,814 in gold, and 28 ounces of silver, valued together at $2,825. The Lookout group 3½ miles south of Eldorado was developed, and some ore treated in an amalgamation mill yielded bullion that was shipped to the mint. From the Pyramid mine 3 tons of ore were shipped to a custom cyanide plant. The Overlook group near Rescue was developed through its 300-foot tunnel and during four months of the year work was devoted to sluicing the mine dump. The three placer producers reported bullion amounting to $215 recovered from specimen gold and sold to merchants.

Garden Valley district.—Four lode mines in the Garden Valley district produced 67 tons of ore yielding $1,725 in gold, and 16 ounces of silver, valued together at $1,731. The French claim and its 3-stamp mill were operated and produced a little gold; the Golden Egg between Georgetown and Poverty Creek produced some bullion from pocket mining; and from the Oro Fino property gold ore was hauled to the Frog Pond 2-stamp amalgamation mill near Garden Valley for treatment.

Georgetown district.—Seven placers and fourteen lode claims in the Georgetown district produced 357 tons of ore, $14,641 in gold, and 106 ounces of silver, valued together at $14,682. The Ruby Consolidated property, opened by a 900-foot tunnel, produced gold from 104 tons of ore treated in a 2-stamp mill. Small lots of ore from pocket mining were treated in hand mortars and represented the principal part of the district production. The placers produced $3,927 in gold and 24 ounces of silver, valued together at $3,936. Most of the gold was reported from the Black Gold, California Maui, and Golden State properties; the location of these placers was not definitely determined.

Grizzly Flat (Mt. Pleasant) district.—Three lode mines and one placer in the Grizzly Flat district produced 250 tons of ore, $6,676 in gold, and 132 ounces of silver, valued together at $6,727. All the ore produced was of very high grade and was treated by amalgamation; much of it was ground in hand mortars. The Middle End or Sciaroni mine produced 200 tons of ore which were treated in a 5-stamp mill equipped for amalgamation and concentration; the gold concentrates were shipped to the smelter and the bullion to the mint. The mine is opened by a tunnel 380 feet long and has 400 feet of raises and drifts. Other producers of bullion were the Humbug and Mt. Pleasant properties. The latter is opened by a vertical shaft 1,000 feet deep; as this is filled with water, the only ground available for prospecting was that in the upper tunnels and winzes. The Pine Hill placer on McKinney Creek produced some gold by drift mining.

Indian Diggings district.—At the Yellow Jacket drift placer gold 0.938 fine was produced between January and March.

Placerville district.—Thirteen placers and eight lode claims in the Placerville district produced 5,513 tons of ore, $29,904 in gold, and 293 ounces of silver, valued together at $30,017. Most of the gold came from the Van Hooker or Harmon group, developed by a 1,586-foot tunnel and 485 feet of drifts. The property is equipped with a 10-stamp mill and gravity concentrator, from which bullion was shipped to the mint and sulphide concentrates to a custom cyanide plant. The property of the Kelsey Mining Co., the next largest producer in the district, is opened by 2,000 feet of tunnel and 100 feet of drifts. The ore is mostly sulphide containing gold and silver and is treated in the 10-stamp amalgamation-gravity concentration mill. Electrical equipment for operating the concentrator and mill was installed in 1930. Gold bullion and concentrates were shipped to the smelter. At the Slate Mountain property gold was recovered by amalgamation from ore treated in a 10-stamp mill. About 1,000 feet of development work were done in 1930. Other producers reported bullion from pocket mining. The placer producers reported $6,145 in gold and 33 ounces of silver, valued together at $6,158. The most important operations were at the Rising Hope drift placer, which was taken over by the Aladdin Gold Mining Co. in June. The company controlled approximately 320 acres of ground and treated about 1,000 cubic yards of gravel to the end of the year. At the Hook and Ladder drift placer near Smithflat the owners worked intermittently and produced a little gold. Some gold was also produced from the Hinds placer in Pleasant Valley and the Starbuck placer on Sweetwater Creek. Miscellaneous small producers worked on the North Fork of the Cosumnes River and in Slug Gulch sluicing gravel.

Spanish Dry Diggings district.—The Sliger Gold Mining Co. developed its lode mine 4 miles north of Greenwood; the gold was recovered from ore in a 25-stamp amalgamation-gravity concentration mill, which was operated one shift a day for 10 months. Sulphide concentrates were shipped to the smelter, and gold averaging 0.927 fine went to the mint.

FRESNO COUNTY

Metal production from all sources in Fresno County in 1930 amounted to $5,916 in gold and 55 ounces of silver, valued together at $5,937. The Kings River Mining & Milling Co. did some development work at its property 8 miles east of Piedra. The amalgamation-gravity concentration mill, equipped with a 5-foot Huntington mill, was partly dismantled, and the copper plates were sold. The gravels in the vicinity of Friant on the San Joaquin River contain a few cents a ton in gold, and the Grant Service Rock Co. recovered 1 or 2 cents a ton as a by-product. The gravel is handled with a dragline scraper, and the wastes are sluiced over riffles.

HUMBOLDT COUNTY

The production of gold, silver, and copper in Humboldt County in 1930 was valued at $2,513, compared with $13,834 in 1929. This decided decrease was due to the cessation of mining copper ore at Horse Mountain in 1929.

Horse Mountain district.—Some ore from the Horse Mountain mine remained on the boat docks at Eureka after the shipment of about 500 tons was made to England in 1929. This ore was sold to a smelter in 1930 and averaged about 5 per cent of copper.

Orleans district.—Six placers and three quartz mines in the Orleans district produced 54 tons of ore, $2,088 in gold, and 22 ounces of silver, valued together at $2,097. Gold ore mined from a small quartz stringer, opened in a prospect on the left bank of the Klamath River between Orleans and Somes Bar, yielded gold 0.745 fine in an arrastre. Gold of the same fineness was produced from 50 tons of quartz mined from the Chilton prospect on Perch Creek. The placers, all of them on the Klamath River below or above Orleans, were worked by hydraulicking. The Hickey property on Camp Creek was the principal producer worked from February to May; the gold yield was 0.887 fine. Other placers operating were the Orcutt, Rocky Point, and Rough & Ready.

IMPERIAL COUNTY

Very little mining was carried on in Imperial County in 1930, and the value of the metal production ($148) was much below that in 1929. Gold was the only metal reported in 1930 and was produced in the Cargo Muchacho or Hedges district from dry placering. Some experimental work was done on old mill tailings from the American Girl mine, but no production of metals was reported.

INYO COUNTY

The value of the metals produced in Inyo County increased from $127,598 in 1929 to $236,817 in 1930, due to the increased production of lead. The principal activity was at the Estelle-Cerro Gordo property 8 miles east of Keeler, operated by the American Smelting & Refining Co.

Carbonate district.—The New Sutherland Divide Mining Co., lessee of nine claims known as the Carbonate or Queen of Sheba group located on the eastern slope of the Panamint Range of mountains 40 miles northeast of Zabriskie, produced and shipped about 50 car lots of lead ore. The report [13] of the State mineralogist for 1926 says that the country rock is limestone which has been greatly faulted.

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[13] State Mineralogist, Twenty-second Annual Report: 1926, p. 480.

The limestone is cut by intrusions of diorite. The ore occurs as replacement ore bodies in limestone, being principally carbonate of lead, with some galena, and is deposited in irregular lenticular masses along a fault plane. The width of the ore bodies ranges from 3 to 15 feet. The ore is said to average 15 per cent of lead and 8 ounces of silver to the ton. The property has been worked periodically since 1914. Development work consists of 3 tunnels driven on the ore body.

Cerro Gordo district.—The output of the Cerro Gordo district consisted of 3,282 tons of lead ore yielding metals valued at $155,398; the ore was shipped to the smelter. The Estelle group, including the Cerro Gordo mine, and the Santa Rosa property were the only producers. These properties have operated for many years and are opened by incline shafts and tunnels. Descriptions of the mines in the district are given in the report[14] of the State mineralogist for 1926.

Chloride Cliff district.—The Old Mill group and Rose claim at Chloride Cliff produced 41 tons of lead ore. Some pannings from surface material on the Yokia claim yielded $85 in gold. The properties are 19 miles from Beatty, Nev., from which shipments of ore are made to the smelter in Utah.

Fish Creek district (*Big Pine*).—Three lode mines produced 136 tons of ore yielding $2,649 in gold, 1,078 ounces of silver, 237 pounds of copper, and 31,271 pounds of lead, valued in all at $4,659. About half of the ore was of milling grade and was treated in gold and silver mills, producing bullion and concentrates; the rest of the ore was shipped to a smelter from Zurich. The principal gold production was from the Commetti property, which is opened by a 200-foot incline shaft and has 500 feet of drifts with a tunnel 400 feet long; a 3-stamp amalgamation and gravity concentration mill was operated. At the Cleveland mine, which is opened by several tunnels, some development was done in 1930; the 40-ton Ellis ball mill, equipped with Myers concentrators and Gibson amalgamators, was operated.

Resting Springs district.—Some lead ore, produced in the Resting Springs district, was shipped from the Gunsite mine, the property of the Tecopa Consolidated Mining Co., under lease during part of 1930. The 75-ton concentration mill was not operated.

Slate Range district.—The Ophir mine and 100-ton gravity concentrator in the Slate Range district were operated during January. Some crude ore and concentrates were shipped to a smelter. The equipment of the mill consists of a Wheeling jaw crusher, Symons cone crusher, Hardinge mill, Dorr simplex classifier, and Dorr classifier, with two Wilfley sand tables and four Wilfley slime tables. The six tables made three products each: A concentrate which was thickened, filtered in an Oliver filter, and shipped; a middling product which was returned to the mill circuit for regrinding; and the tailings which were sent to the storage pond. The flotation cells planned for the mill early in 1930 were not installed. The Ophir mine is opened by a 600-foot shaft; considerable ore carrying 12 per cent of lead and 8 to 10 per cent of zinc is developed.

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[14] State Mineralogist, Twenty-second Annual Report: 1926, pp. 480, 483, and 498.

South Park district.—The Radcliff mine in the South Park district, opened by several tunnels, was developed in a small way during 1930. About 200 tons of ore and 1,600 tons of old tailings were treated in a cyanidation plant. About $5,000 in gold bullion was shipped to the San Francisco Mint.

Ubehebe district.—Lessees working on three mine dumps in the Ubehebe district shipped 90 tons of lead and copper ore yielding $279 in gold, 1,006 ounces of silver, 12,804 pounds of copper, and 47,443 pounds of lead, valued in all at $4,703. Most of the ore was from the Butte claims.

KERN COUNTY

The value of the gold and silver produced in Kern County in 1930 was $167,192, compared with $150,733 in 1929. The output was chiefly from gold ore mined in the Randsburg district.

Amalie district.—Some gold ore was produced from the Ferris claim and treated in a 5-stamp mill on the property. Seven tons of silver ore from the Gold Pig mine were shipped to a smelter. From the Juniper claim a little gold bullion was produced and sold to the smelter.

China Grade Flats district.—About 30,000 cubic yards of gravel on the Kern River were handled by the Kern Rock Co., leasing on the property of the Guayule Land Co. and the Kern County Land Co. 5 miles northeast of Bakersfield. During the handling of this material for the manufacture of rock products some gold was caught with riffles and burlap tables.

Clear Creek district.—The Ederl Mines (Ltd.) operated a 25-ton amalgamation-concentration plant in the Clear Creek district and produced bullion and sulphide concentrates which were sent to the mint and smelter. The property is opened by tunnels, and the total development is approximately 1,800 feet. The principal tunnel is 190 feet long.

Cove district.—The Kern Development Co. operated the Big Blue mine in the Cove district, opened by a 2,000-foot tunnel, and did 100 feet of drifting in 1930. The 5-stamp mill crushed 235 tons of ore, from which bullion and concentrates were produced.

Greenhorn district.—The Old Mill property in the Greenhorn district, opened by shallow shafts and a 50-foot tunnel, produced a little gold 0.720 fine recovered in an arrastre. The ore was mined when a 50-foot shaft was sunk. The mine is about 40 miles from Bakersfield.

Green Mountain district.—The Amy property near Tehachapi was under development from April to November, during which time the 10-ton amalgamation and concentration plant was operated. Bullion and concentrates were shipped to the mint and smelters. The property is opened by a 565-foot tunnel and has 300 feet of drifts.

Mojave district (*Rosamond*).—Six lode mines in the Mojave district produced 3,017 tons of ore yielding $23,067 in gold and 2,225 ounces of silver, valued together at $23,924. The Tropico mine and mill were operated six 8-hour shifts a week and the mill treated nearly 3,300 tons of ore, 470 tons of which was custom ore from the properties of the Standard Mining Co., including the Exposed

Treasure lease, and the Stewpot claim. The 10-stamp mill is equipped for amalgamation and cyanidation. The mine is opened by a vertical shaft 700 feet deep and by 5,000 feet of drifts, with 200 feet of drifting done in 1930. The Roydon Mining Co., leasing the Elephant-Hope-Charity-Excelsior group of claims, expended about $5,000 in opening the property which is developed by a 220-foot vertical shaft and two tunnels 1,400 and 1,300 feet long. The 75-ton cyanide and amalgamation plant was remodeled.

Pioneer district (*Keyes*).—In the Pioneer district the Glen Olive claim, developed by two 900-foot tunnels, produced some gold 0.612 fine by amalgamation. The mine was operated throughout the year but the 10-stamp mill only five days.

Randsburg district.—Twenty-nine mines in the Randsburg district (Kern and San Bernardino Counties) produced ore in 1930. The ore from the western part of the district lying in Kern County contained chiefly gold; 16 mines were in operation, and a total of 29,886 tons of ore and old tailings was treated. In the eastern part of the district lying in San Bernardino County 13 mines produced 11,493 tons of ore, largely of milling grade but some of shipping grade containing chiefly silver. The total production of the Randsburg district is reviewed here. Slightly more than half (20,857 tons) of the ore mined was treated by amalgamation in gold and silver mills and yielded bullion containing 5,839.51 ounces of gold and 1,505 ounces of silver. Ore treated by concentration only amounted to 9,766 tons; it was reduced to 1,067 tons of concentrates yielding 1,175.76 ounces of gold and 220,169 ounces of silver. The crude ore shipped to the smelter amounted to 1,788 tons and yielded 812.55 ounces of gold and 218,053 ounces of silver. The old tailings treated by cyanidation amounted to 8,968 tons and yielded 230.82 ounces of gold and 80 ounces of silver. Altogether, 41,379 tons of ore and old tailings yielded $166,587 in gold and 439,807 ounces of silver, valued together at $335,913. The ore and old tailings sold or treated in the district in 1930 yielded on an average of $8.12 in metals a ton.

The Yellow Aster mine was the largest producer in the district of gold and silver from ore treated by amalgamation, with the sands and slimes treated by cyanidation. The mine is opened by a vertical shaft 300 feet deep and has over 5,000 feet of drifts and tunnels. The Yellow Aster mill is equipped with 50 stamps, of which 10 crushed ore produced by lessees. Over 90 per cent of the metal in the ore is saved. Thirty men were leasing on the property, 20 were employed by the company, and a small force was working on the tailing from the old mill dump which was under lease to the Carwymac (Inc.). The Butte Lode Mining Co. turned its property over to lessees, who operated its 5-stamp amalgamation and 20-ton cyanide plant and did about 100 feet of development work in the mine. At the King Solomon property the Shipsey Mining Co. mined 280 tons of ore which was treated in a 5-stamp amalgamation mill. The property is opened by a 650-foot shaft and 4,000 feet of drifts. Other producers of milling ore in the Kern County part of the district were the Big Dyke, Hercules, Lillian V., Sidney, and Winnie. Gold ore was shipped to the smelter from the Big Gold group and Alameda property. Most of the ore from the San Bernardino part of the district was sulphide silver ore from the famous Kelly or

Uranium mine formerly owned by the California Rand Silver (Inc.), which was liquidated in 1929 and succeeded by the Consolidated Metals Corporation. The latter corporation operated from September, 1929, until June, 1930, when the entire property was sold to the Wortley Consolidated Mines (Inc.) and consolidated with the Santa Fe group. The flotation mill on the Uranium group has been in operation since the initial 100-ton plant was started in December, 1921. The mill has been enlarged twice: the capacity was first increased to 200 and then to 400 tons a day. In addition to the ore milled the company and lessees shipped siliceous silver ore to the smelter at Selby. The flotation mill was started in August and to the end of the year treated 9,344 tons of ore from the Uranium group, averaging $2.55 in gold and 22.70 ounces of silver to the ton, and 422 tons of ore from the Santa Fe group, averaging $1.21 in gold and 19.07 ounces of silver to the ton; the concentrates, with the first-class crude ore from the property, were shipped to the Selby smelter. Altogether, a total of 11,483 tons of ore of milling and shipping grades was produced during 1930 from company and lessee operations; it yielded $40,309 in gold and 438,204 ounces of silver. The Uranium group is opened by a 1,500-foot vertical shaft and 30,000 feet of drifts. The Santa Fe group is opened by a 1,200-foot vertical shaft and 6,000 feet of drifts. The flotation-mill equipment consists of 1 Joshua Hendy jaw crusher, 1 Llewellyn jaw crusher, 2 Joshua Hendy tube mills, 2 Joshua Hendy ball mills, 4 Dorr classifiers, 120 Minerals Separation flotation cells, 1 American filter, 1 Louden dryer, and 8 Dorr thickening tanks. The mine water, which makes at the rate of 15,000 gallons a day, was used in the mill. All machinery was moved from the North Rand group, and the property was abandoned. From the time of discovery in 1919 to July, 1930, according to the State mineralogist,[15] the California Rand Silver mine produced about $16,000,000 in gold and silver and paid about $4,500,000 in dividends.

Woody district.—The Blue Mountain property of the Comet Mining Co. was under development, and 200 feet of drifting were reported. The property was equipped with a 10-stamp mill, which operated on ore taken out in development of the mine.

LASSEN COUNTY

The value of the gold and silver produced from mines in Lassen County increased from $170 in 1929 to $2,969 in 1930.

Diamond Mountain district.—The Blue Bell claim in the Diamond Mountain district 7½ miles south of Susanville produced two small lots of gold ore which were shipped as a test to the smelter. The property is opened by a 220-foot tunnel and 100 feet of crosscuts.

Milford district.—Three lode mines in the Milford district produced 96 tons of ore, most of which was treated by amalgamation. The Golden Eagle mine dump was worked over, but operations were brought to a close in December by a fire which destroyed the cyanide plant. At the Badger mine of the Honey Lake Gold Mining & Development Co. the tunnel was extended to 800 feet, and the 10-stamp amalgamation mill was operated on ore taken out during development. The Twelve O'clock property near Milford, which has a 10-ton ball mill, recovered some gold by amalgamation. The mine is opened by a 175-foot tunnel.

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[15] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 273.

MADERA COUNTY

Lode and placer mining in Madera County in 1930 yielded gold, silver, copper, and lead valued at $1,395 compared with an output of gold, silver, and copper in 1929 valued at $5,317.

Chowchilla River district.—Prospectors recovered some gold 0.755 fine from gravel by sluicing near Mist.

Hildreth district.—At the Hanover property in the Hildreth district some gold 0.696 fine was produced. The Bonita Ora claim, opened by two shafts 65 and 62 feet deep, produced gold ore shipped to a smelter. The Mud Springs property during development produced a little bullion. The Galena King property produced 5 tons of lead ore.

Potter Ridge district.—The Morning Star placer on the Fresno River near the mouth of Grub Gulch was operated three months and produced a little gold 0.822 fine.

MARIPOSA COUNTY

The value of the metals produced in Mariposa County was $59,787 in 1930, a marked decrease from $92,811 in 1929. More than half of the gold produced in the county in 1930 came from the Bagby, Coulterville, and Hite Cove districts.

Bagby, Coulterville, and Hite Cove districts.—Eight lode mines and 18 placer operations produced 3,260 tons of ore, $42,904 in gold, and 542 ounces of silver, valued together at $43,112. The principal part of the ore output of the districts came from the Original mine operated by a new company after June 17. All the ore from the Original mine was treated in a 10-stamp amalgamation-gravity concentration mill, and bullion and some sulphide concentrates were shipped. The mine is opened by a 1,100-foot incline shaft and several thousand feet of drifts. At the Argo mine, which has a 3-stamp amalgamation-gravity concentration mill, ore and concentrates were produced. The property is opened by an incline shaft 115 feet deep, 430 feet of drifts, and 200 feet of raises. The Eureka claim produced some rich specimen ore from which gold 0.839 fine was recovered. The Evening Star produced a little gold ore which was amalgamated. The Butte Boys mill near Bagby was equipped with flotation cells the latter part of 1930, after the recovery of metal by amalgamation alone was found to be unsatisfactory. From the Brown Bear property, which includes the Grand View, Henrietta, and Live Oak group, some gold was recovered from the milling of 60 tons of ore. The property is opened by an incline shaft sunk 265 feet. Small seams of rich specimen gold were mined from the Maria claim. The company operating the Feliciana property in the Hite Cove district shipped bullion 0.836 fine in gold and some sulphide concentrates recovered from ore treated in an amalgamation-gravity concentration mill. There was some placer mining on Maxwell Creek near Coulterville; prospectors were busy, with sluice box, cradle, and gold pan, working bed rock during the dry season.

The gold sold to the mint was 0.815 to 0.880 fine. Of the total gold output of the districts $2,559 came from placers.

Kinsley district.—A 25-ton amalgamation-gravity concentration mill was installed on the Marble Springs group on Bull Creek, 1 mile from Kinsley, but was not operated in 1930.

Mount Bullion, Colorado, and Whitlock districts.—The Belmont Metals Corporation produced about 1,200 tons of ore from the Colorado mine and shipped bullion recovered in a 10-stamp amalgamation-concentration plant. The mine is opened by a 220-foot shaft and has 900 feet of drifts. Development in 1930 consisted of 122 feet of raises and 100 feet of drifts. At the Whitlock mine a sensational pocket of specimen gold was mined early in the year, and the gold specimens were on exhibit in San Francisco before melting. Mill ore was treated in the 5-stamp amalgamation mill, which operated about 30 days. The mine is opened by an incline shaft 500 feet deep and has 1,000 feet of drifts and an 1,800-foot tunnel. The shaft was extended 250 feet in 1930.

Quartzburg district (Hornitos).—Five lode mines and one placer in the Quartzburg district produced 173 tons of ore, $2,109 in gold, and 13 ounces of silver, valued together at $2,114. All the mines are near Hornitos. The principal producer was the Charles and Patricia claim, from which a little ore was treated at Quartzburg in the De Hart custom plant equipped with a Huntington mill. Other claims developing and producing were the Brownie, Fair View, and Pine Cone. Small placer operations in the vicinity yielded a little gold.

MERCED COUNTY

In 1930 the yield of gold and silver in Merced County, with the exception of prospectors' gold sold to merchants, was from gold-dredging operations and was valued at $88,474. The dredge near Snelling, operated since 1927 by the La Grange Gold Dredging Co. on a bench above the Merced River 1½ miles west of Merced Falls, was purchased in December by the Yuba Consolidated Gold Fields. A total of about 960,000 cubic yards of material was handled at the placer property during 1930 by an electrically operated boat equipped with 10½-cubic foot buckets.

MONO COUNTY

The value of the mine production of metals in Mono County decreased from $42,351 in 1929 to $29,659 in 1930, due largely to the falling off in the output of silver.

Blind Spring Hill district.—The Comanche Mining & Reduction Co. operated a property near Benton during January and then closed indefinitely. Some copper ore mined the previous year was shipped to a smelter. The mine is opened by an incline shaft 1,400 feet deep and a tunnel 4,325 feet long.

Bodie district.—Four lode mines in the Bodie district produced 1,440 tons of ore yielding $23,855 in gold and 1,982 ounces of silver, valued together at $24,618. The principal part of the output was oxidized ore from the Red Cloud mine and the Standard mine dumps. The Standard mill was reconstructed and leased by the Clinton-West Co., who used the 5-stamp amalgamation mill to which a 125-ton flotation unit was added. Gold bullion and concentrate were produced. The ore was dry crushed to 2-inch size, and the undersize from a 7-inch grizzly was fed to a 4-foot Symons cone crusher set to 2-inch; the fine-grinding equipment, consisting of an 8-foot by 30-inch Hardinge ball mill, operated in closed circuit with a classifier to 60-mesh and a 35-ton conditioning tank; the classifier-overflow pulps went to six MacIntosh and Allen air cells. Rough concentrates were delivered to a MacIntosh cleaner and recleaned, and the mill absorption sand was sent to a Deister table. The recovered concentrates were mixed and shipped to the Selby smelter by way of Thorne, Nev. The 5-stamp mill was operated 10 days and the flotation mill 35 days in 1930. All holdings and the lease were sold to the Treadwell Yukon Co. (Ltd.) in August. At the Red Cloud 20-stamp amalgamation-gravity concentration plant the ore was crushed through a 35-mesh screen, and 80 per cent of the gold was recovered by amalgamation and 5 per cent in the concentrates. The Red Cloud is opened by a vertical shaft 840 feet deep and about 26,000 feet of old and new laterals. Development in 1930 consisted of 6,948 feet of drifts, 403 feet of raises, and 4,406 feet of crosscuts.

Masonic district.—The Sarita Mining & Power Co. (Ltd.) produced about 2,700 tons of ore, from which gold and silver bullion was recovered in a 50-ton cyanide plant. The property, opened by a 1,200-foot tunnel and 500 feet of drifts, was closed in October.

NAPA COUNTY

The value of the production of metals in Napa County in 1930 was $140,317, a gain over 1929 of $44,905, nearly half of which was in gold.

Calistoga district.—The Palisade mine, operated by the Banner Development Co., produced 14,890 tons of ore treated in a 100-ton flotation plant equipped with 6 Kraut flotation cells. The mill was closed in November for lack of water. The mine is opened by a 550-foot vertical shaft and has a 750-foot tunnel and 1,200 feet of drifts. Flotation concentrates, containing principally silver with some gold, were shipped to a smelter.

NEVADA COUNTY

The value of the metals produced in Nevada County in 1930 was $2,219,896 compared with $1,830,889 in 1929, and the county ranked second to Plumas County in total value. Nevada was the leading county in output of gold in 1930 and yielded over 23 per cent of the total production of the State.

French Corral district.—Twenty-eight placer operators in the French Corral district reported $4,633 in gold and 28 ounces of silver, valued together at $4,644. Much of the gold was purchased by merchants in the region, who control some of the ground from which production was reported. No very large or important operations were reported.

Graniteville (*Eureka*, *Washington*) *district.*—Three lode mines and nine placers in the Graniteville part of the district produced 331 tons of ore, $4,254 in gold, and 37 ounces of silver, valued together at $4,268. The Ancho mine, operated by the Yellow Tiger Consolidated Mining Co., produced ore treated in a 10-stamp amalgamation-gravity concentration mill. Bullion 0.793 fine was sold to the mint. The Liberty mine produced a little gold bullion taken out in development of the property. In the Washington part of the district three lode mines and four placers produced 27 tons of ore, $12,526 in gold, and 61 ounces of silver, valued together at $12,549. The Gaston mine, equipped with a 10-stamp amalgamation mill, produced gold bullion 0.798 fine. The mine is opened by 4,578 feet of tunnel levels and 2,000 feet of drifts. Some work was done at the Treasure Box mine, opened by a 500-foot tunnel. Development work, which was started in 1927 at the Spanish mine in the Washington district, was completed to a depth of 300 feet. Successful pilot-mill tests of Spanish mine ore encouraged the owners to start construction of a larger mill in September; this was not completed until April, 1931. The new mill is equipped with 22 Kraut cells for selective flotation, making copper, lead, zinc, and iron flotation concentrates and a barite table concentrate. The Omega Hill Mining Co. did considerable sluicing and hydraulicking with two giants of 500 cubic yards daily capacity each. The gold produced was 0.953 fine.

Grass Valley and Nevada City districts.—Forty-two operators of lode mines and eight placer operators in the region covered by Grass Valley and Nevada City reported 224,080 tons of ore, $2,156,044 in gold, 60,036 ounces of silver, 16,945 pounds of copper, and 17,812 pounds of lead, valued in all at $2,182,252. The gold output was larger than that of any other district in California; it included $2,950 in placer gold. The Graham Bros. drift mine near Nevada City was the largest producer of placer gold in the district; many prospectors sluicing gravel along Deer Creek and the Yuba River contributed to the placer output. Considerable gold of unknown origin was credited to various mines in the region. Most of the ore mined at Grass Valley and Nevada City was treated in stamp mills in amalgamation-cyanidation-gravity concentration and flotation concentration mills; one mill used all-flotation. The total mine and mill output included 81 tons of first-class smelting ore, 3,186 tons of sulphide concentrates reground and treated by cyanidation, and 889 tons of concentrates smelted. Bullion recovered from current sands and slimes was credited to the original ore. The total ore yielded on the average $9.73 in metals a ton.

The Empire Star Mines Co. (Ltd.), the largest operating company at Grass Valley, was controlled by the Newmont Mining Corporation, the new owners having taken charge May 1, 1929. Three veins, the Empire, North Star, and Pennsylvania, with interlinked veins, are actively worked. The largest and most productive ore shoot has been in the Empire, opened by a 4,600-foot inclined shaft following the vein in its upper part; but between 2,800 and 4,200 feet the dip of the vein steepens to 55°, and in this lower section the shaft goes off into the hanging wall. From the 4,600 to the 7,000 foot level an inclined winze was sunk on the vein near the south end of the main ore shoot. North Star ore was mined in 1930 chiefly by lessees. At the mine shaft a 200-ton crushing plant equipped with grizzlies, sorting tables, and Blake crushers prepared the ore for the Empire mill, to which nearly all the ore was carried by a 6,000-foot aerial tramway. Part of the ore was handled in the old 60-stamp amalgamation-gravity concentration mill at the North Star shaft, recently reconditioned. Kraut cells installed in the old cyanide plant were used to experiment with the reject from the Wilfley tables. The flotation product was added to the table concentrate and hauled by truck to the Empire mill for treatment by cyanidation. The Pennsylvania shaft, like the North Star shaft, has a 200-ton crushing plant, but the ore is hauled on an electric trolley-line train to the Empire mill. A 100-ton crusher is used at the Empire shaft. At the 400-ton Empire mill the equipment consists of 80 stamps of 1,780 pounds each, 16 amalgamation plates, 4 classifiers, 16 Wilfley concentrators, and 4 Frue vanners. All concentrates are weighed, sampled, and ground in a ball tube mill. The reground concentrate is reconcentrated on a Wilfley table, which makes a narrow streak of lead concentrate rich in gold; shipments of the lead concentrate are made twice a year to the smelter. The reject from this Wilfley concentrate flows to four Devereaux agitators. The sands and slimes go to 3 flat Merrill cone settlers and 7 cone classifiers, the slime going to 6 Dorr thickeners, 2 Oliver filters, and 6 Pachuca agitators and being given a water wash through 4 Oliver filters. The sand from the cone classifier goes to eight 170-ton leaching tanks. A Berdan pan is used for the battery and daily plate amalgam. The zinc precipitate feed is dewatered in two Merrill presses, and the gold precipitate is prepared for melting in Rockwell furnaces. The cyanide gold bars and mill bars are sold to the Selby smelter or the San Francisco Mint.

The Idaho Maryland Mines Co. had two 20-stamp amalgamation-gravity concentration mills in operation, one at the Idaho Maryland shaft near Grass Valley and the other at the Brunswick mine; the latter mill had not been operated for a number of years. Flotation equipment was placed in the Brunswick mill the latter part of 1930, and ore was transported by truck from the Idaho Maryland shaft a mile distant. Bullion is shipped to the San Francisco Mint and sulphide concentrates are sent to the Selby smelter. The mine is opened by a vertical shaft 2,000 feet deep and by 4,000 feet of drifts. About 4,000 feet of drifting, crosscutting, and raising was done in 1930.

The Murchie mine in the Banner section near Nevada City, operated by the American Foundation Co., doubled its 1929 output. The mine and mill operated continuously throughout 1930. A new ore shoot was developed on three levels in the newly acquired Texas ground to the west of the original holdings, and a new pumping system of five times the former capacity was installed. In the 200-ton flotation plant crude ore was crushed to 2-inch size with Blake crushers, to ½-mesh by twenty 1,080-pound stamps, and to 90 per cent minus 100-mesh in closed circuit with classifier. The overflow goes to six Kraut roughing cells, the tailings go to waste, and the middling concentrate goes to two finishing Kraut cells. The middling is returned to the roughing circuit, and the concentrate goes to thickeners and filters and then is sacked for shipment. The ratio of concentration in 1930 was 3.9 tons of ore to 1 of concentrate. The mine development in 1930 consisted of deepening the 85° inclined shaft to 1,326 feet, and of 2,063 feet of drifting, 153 feet of crosscuts, and 1,107 feet of raises.

The Hoge mine, under development the entire year by the Hoge Development Co., finished about 2,600 feet of drifts and crosscuts and shipped some gold sulphide ore taken out in development work. A little bullion was recovered in cyanidation tests made at the New England mill near Nevada City. The Hoge mine is opened by a 327-foot shaft. Minerals observed in the ore mined were lead and zinc, and also a little molybdenite and wulfenite. The Queen Lil mine was worked in 1930 through the Champion mine shaft, and about 800 tons of ore were treated in a 10-stamp amalgamation-gravity concentration mill. Some of the concentrates produced were reground in amalgamation pans but were found too low grade to pay.

North Bloomfield district.—Two placers and one lode mine in the North Bloomfield district produced $1,022 in gold and 6 ounces of silver. The Mabel drift placer on Humbug Creek was the chief producer.

You Bet district.—Twelve placer operators in the You Bet district reported $3,569 in gold and 23 ounces of silver, valued together at $3,578. The largest output of gold in the district came from the You Bet property, at which sluicing and drifting operations were carried on by lessees. The Quaker Hill drift placer also produced some gold.

PLACER COUNTY

The value of the mine production of gold and silver in Placer County in 1930 was $29,411 compared with $34,824 in 1929. Most of the mining activity in the county was confined to surface and drift placers; quartz mining yielded $3,564 in gold and silver.

Butcher Ranch district (Colfax).—Placers on Bear River and vicinity were worked by prospectors who sold small lots to dealers and merchants at Colfax; the total amounted to $2,837 in gold and 18 ounces of silver. Most of the gold included in the total was from the Whiteman and Mather mine on the Middle Fork of the American River, east of Butcher Ranch post office.

Canada Hill district.—Most of the metal output of the Canada Hill district in 1930 was made up of small lots of placer bullion sold to merchants and, including the output of the California Placer Mines (Inc.), amounted to $2,081 in gold and 10 ounces of silver. The bullion sold to the San Francisco Mint was 0.810 to 0.901 fine in gold.

Deadwood district.—At the drift placer of the Double O Mining Co. 7 miles northeast of Michigan Bluff in the Deadwood district a lessee produced a little gold 0.915 fine. The company did some retimbering and repair work on the property.

Dutch Flat district.—One lode mine and three placers in the Dutch Flat district produced $2,123 in gold and 19 ounces of silver. The output was from the Black Hawk quartz mine and the Mary Red, Steiner, and Trixie placers.

Forest Hill district.—One quartz mine and five placers in the Forest Hill district, together with miscellaneous small lots of bullion, yielded $5,531 in gold and 32 ounces of silver. The Three Queens mine was operated by a lessee who recovered gold 0.828 to 0.900 fine from small lots of high-grade ore ground in a hand mortar. The drift mine of the Mayflower Gravel Mining Co. was the chief producer of placer gold in the district; the gold, 0.823 to 0.883 fine, was taken out during development of the property. At the Millers Defeat drift placer some tunnel work and prospecting were done.

Iowa Hill district.—Prospectors sold small lots of gold to merchants in the Iowa Hill district, credited with a production of $4,299 in gold and 29 ounces of silver in 1930. The Star United drift placer near Indian Canyon was the largest producer in the district.

Last Chance and Michigan Bluff districts.—Lode and placer mining in the Last Chance and Michigan Bluff districts yielded $9,196 in gold and 53 ounces of silver. The Rublin Quartz Mining Co. near Last Chance operated its stamp mill and produced a little gold from ore taken out in developing the property, which is opened by a tunnel. Drift placer producers in the territory were the Baker Divide, Blanche, De Maria, Home Ticket, and Kavanaugh. Ground sluicing was reported on the Bachelor, Big Gun, Crystal Quartz, Gorman Consolidated, and Swift Shore placers.

New England Mills district (*Weimar*).—The Annie Laurie mine near Weimar produced 60 tons of gold ore, from which gold (0.822 fine) was recovered in a 4-stamp mill on the property.

Ophir district.—The Crosby Hill, Fountain Head, Independence, and two other placers produced $893 in gold and 7 ounces of silver.

PLUMAS COUNTY

The value of the metals produced in Plumas County in 1930 was $3,108,183 compared with $4,996,967 in 1929, a decrease of over a million dollars, due to the marked falling off in the output of copper. The county, however, continued to rank first in total value of metals produced.

Genesee district.—According to its annual report,[16] the Walker Mining Co. in the Genesee district produced ore and concentrates containing copper, gold, and silver valued at $1,921,355. The total value was the largest for recovered metals for any single mining property or district in California in 1930. The company operated its mine and flotation plant the entire year, averaging 1,554 tons of ore a day, and reduced 518,509 dry tons of ore containing 1.6713 per cent of copper, and 0.8560 ounce of silver and 0.0532 ounce of gold to the ton, compared with 513,526 tons in 1929 assaying 1.8096 per cent of copper, and 0.79 ounce of silver and 0.055 ounce of gold to the ton. In 1930 the ratio of concentration was about 15 tons of ore to 1 of concentrate, and the total recovery of copper in concentrate was 91.06 per cent. The concentrates shipped amounted to 33,251 dry tons, with a metal content of 15,775,669 pounds of copper, 377,765 ounces of silver, and 16,462.05 ounces of gold. In addition to the above, 502 pounds of copper, 228 ounces of silver, and 436.92 ounces of gold were recovered from lime scale taken from the flotation cells and launders. All product is handled over an aerial tramway connecting the mine with the Western Pacific Railroad at Spring Garden. The tramway is 9 miles long and carries 104 buckets, each with a capacity of 700 pounds. The concentration equipment consists of one 15 by 24 inch and two 8 by 20 inch Blake crushers; 2 sets of rolls 24 by 55 inches each; 3 revolving screens, two 1$\frac{3}{4}$-inch and one 1-inch mesh; 1 Marcy No. 77 and 3 Marcy No. 75 ball mills, each with Dorr classifier; 4 sets of Callow cells, rougher, and finisher; two 24½ by 11 foot and one 45½ by 11 foot thickeners; and one 8 by 12 foot Oliver filter. The annual report of the company continues:

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[16] Walker Mining Co. Annual Report for year ended December 31, 1930.

> Referring to the income account there is shown an operating profit of $356,110.35. The corresponding amount for the year 1929 was an operating profit of $1,015,758.84. The lower operating profit for 1930 as compared to that of the previous year was due to a decrease in the price of copper.
>
> The average price received during the year 1930 was 12.971 cents per pound, and the price for 1929 was 18.0765 cents per pound.
>
> The mining costs for 1930, based on a ton of crude ore for breaking, producing, milling, and delivery of concentrates to the railway, were $2.5066. (The costs for 1927, 1928, and 1929 were, respectively, $2.7523, $2.3391, and $2.5578.) * * *
>
> A development program was planned and carried on, so that a ton of ore was placed in the reserve for each ton extracted; 8,442 feet of new development work was done during the year for the purpose of opening up ore bodies, in addition to 6,932 feet of advances made in the course of the mining operations—at a total cost of $187,248.58.
>
> The development of the Piute Ore Body above the 700 level was continued, and the 3-compartment winze below the 7th level was extended 681.5 feet to a total depth on the incline of 738 feet. Crosscuts to the vein on the 8th and 9th levels were driven, and exploration on the 10th level began near the end of the year.
>
> Stope preparation continued on the 8th, 9th, and 10th levels in the South and Central ore bodies. The 9th level was extended north and should reach the south end of the North Ore Body early in the year 1931.
>
> The mill was not run at capacity all year, as it was considered good business to conserve ore for better metal prices.
>
> After deduction of smelter contract had been made, copper paid for by the smelter from concentrates and lime scale amounted to 14,654,793 pounds. Cost of producing this copper, after crediting gold and silver content and including refining charges, was 10.542 cents per pound. This cost includes development in previous years in the amount of $46,009.78, written off during 1930 to complete this item, but does not include depletion or depreciation. * * *
>
> The operating costs per ton of crude ore for breaking, producing, milling, and delivery of concentrates at Spring Garden for the year were as follows:

Breaking ore, including shaft sinking and current development	$1.2667
Producing ore, including current development and waste	.5530
Mill operating	.6366
Tramway (per ton of concentrates $0.7837)	.0503
Total	2.5066

> Capital expenditures during the year were as follows:

Mine department	$20,371.26
Mill department	24,730.40
Camp buildings and miscellaneous equipment	53,777.15
Total construction and equipment	98,878.81

Lights Canyon district.—The Engels Copper Mining Co. was the only metal producer in the Lights Canyon district in 1930. The land holdings of the company embrace 36 patented and 142 unpatented mining claims (approximately 3,650 acres); 900 acres are owned for timber, tailings storage, etc. The company also owns, jointly with the Western Pacific Railroad, the 22 miles of standard-gage railroad completed in 1927 at a cost of $485,000 to connect Paxton with Engels. The geology and ore deposits and the mining methods and costs at the Engels mine have been described [17] recently and are of interest in connection with this report. The Engels Copper Mining Co., controlled by the California Copper Corporation, continued operation of its mines and 1,500-ton flotation mill until July, after which both mining and milling operations were suspended owing to the low price of copper. According to its annual report [18] the company milled at Engels 176,680 tons of ore averaging 1.296 per cent copper, with a concentration ratio of 25.41 tons of ore to 1 ton of concentrates. The concentrates contained 4,072,628 pounds of copper, 44,471 ounces of silver, and 495 ounces of gold. The recovered copper sold for $616,837.68 or 15.146 cents a pound, the silver for $17,041.66 or 26.094 cents an ounce, and the gold for $9,411.42 or $19.00 an ounce. For these metals the company received a total of $643,290.76. Freight on concentrates and smelting charges to Garfield, Utah, were $188,868.45, leaving an operating income of $454,422.31. Deduction of operating expense for the period—amounting to $442,981.04, not including depreciation of plant and equipment and depletion of ore—left an operating profit of $11,441.27. Added to this amount was income from interest, rents, etc., amounting to $16,823.51. The net result was a total income of $28,264.78, not including depreciation and depletion. There were heavy write offs for the year, resulting in a net loss of $236,630.21 carried to surplus.

The company report continues with the cost of copper production as given in the tables that follow.

Cost of copper production, 1929 and 1930

		1929	1930	
		Cost per pound of copper (cents)	Total cost	Cost per pound of copper (cents)
Operating cost		7.5396	$442,981.04	10.8770
Freight and smelting charges	$188,868.45			
Credit by gold and silver	26,453.08	4.5571	162,415.37	3.9880
Operating and marketing cost		12.0967	605,396.41	14.8650
Add reserve for depreciation		.7390	81,914.29	2.0113
Add—development and exploration		5.1583	115,179.26	2.8281
Total cost of copper production		17.9940	802,489.96	19.7044
Shutdown expense		----------	15,046.50	.3695
		17.9940	817,536.46	20.0739

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[17] Knopf, Adolph, and Anderson, C. A., The Engels Copper Deposits, Calif.: Econ. Geol., vol. 25, No. 1, 1930, pp. 14–35.

Fenner, C. N., The Engels Copper Deposits, Calif.: Econ. Geol., vol. 25, No. 4, 1930, pp. 420–425.

Nelson, W. I., Mining Methods and Costs at the Engels Mine, Plumas County, Calif.: Inf. Circ. 6260, Bureau of Mines, 1930, 22 pp.

[18] Engels Copper Mining Co., Seventeenth Annual Report, for year ended Dec. 31, 1930.

Cost per ton of ore, 1929 and 1930 [1]

	1929		1930	
	Total cost	Cost per ton of ore	Total cost	Cost per ton of ore
Mining cost	$414, 407. 84	$1. 0490	$203, 704. 74	$1. 1530
Milling cost	257, 927. 60	. 6529	133, 718. 75	. 7568
Taxes—interest—insurance	80, 735. 74	. 2044	58, 164. 76	. 3292
Electric haulage	31, 590. 91	. 0800	15, 286. 79	. 0865
Loading concentrates	2, 916. 56	. 0074	1, 748. 06	. 0099
General expense—administration and superintendence	41, 788. 79	. 1058	30, 357. 94	. 1718
Total operating cost	829, 367. 44	2. 0995	442, 981. 04	2. 5072
Depreciation	81, 293. 44	. 2058	81, 914. 29	. 4636
Development and exploration	567, 417. 71	1. 4363	115, 179. 26	. 6519
Total cost exclusive of freight and smelting charges	1 478, 078. 59	3. 7416	640, 074. 59	3. 6227
Shutdown expense			15, 046. 50	. 0852
	1, 478, 078. 59	3. 7416	655, 121. 09	3. 7079

[1] Ore milled: 1929, 395,042 tons; 1930, 176,680 tons.

RIVERSIDE COUNTY

Eight lode mines in Riverside County in 1930 produced 696 tons of ore yielding $4,833 in gold, 100 ounces of silver, and 5.877 pounds of copper, valued in all at $5,635. The value of the metal output from three lode mines in 1929 was $1,284.

Bendigo district.—Three lode mines in the Bendigo district produced 35 tons of ore shipped to smelters in Arizona. The Riverside Copper Co. (Ltd.) produced oxidized copper ore containing a little silver and gold from its property 6 miles south of Vidal. About $20,000 was expended in development work in 1930. The Rainbow claim was prospected and produced ore assaying over 3 per cent of copper and $14.47 in gold to the ton. The Rattler mine of the Bethel Mining & Leasing Co. produced one lot of ore shipped to a smelter; the ore assayed 2.02 ounces in gold and less than 1 ounce of silver to the ton. The mine is opened by a tunnel 626 feet long.

Piñon Mountain district.—The New Eldorado mine in the Piñon Mountain district was under lease to the Allao Mining Co. during 1930 and produced 260 tons of siliceous gold ore from which about $7 a ton in gold was recovered in a 10-stamp amalgamation mill. The mine is opened by a 500-foot incline shaft on which 50 feet of sinking was done in 1930.

San Jacinto Mountain region.—The Gold Shot Mines (Inc.) operated its property about 30 miles east of Hemet in the vicinity of Tahquitz Creek. Sulphide ore containing gold and silver was mined and treated by amalgamation in a 17-ton Straub mill operated when water was available during August, September, and October. The claims are developed by an 80-foot incline shaft and an 80-foot tunnel. The State mineralogist, on page 502 of his annual report for 1931, states that attempts to exploit mineral deposits in the San Jacinto Mountain region were made at one time at the Hemet Bell mine at Kenworthy; and several shafts, which are still open, were dug many years ago.

SACRAMENTO COUNTY

The value of the gold and silver in Sacramento County increased from $1,493,621 in 1929 to $1,726,025 in 1930. Sacramento ranked third among the gold-producing counties of the State in 1930 by reason of the dredging operations. Some small placer operations and pocket mining were also carried on in the county, but the resulting gold production was small and irregular. The chief dredging operations in 1930 were in the vicinity of Natoma and south of Folsom.

Folsom (*Natoma*) *district*.—Thirteen placer operations, including nine dredges, in the Folsom district had an output of gold and silver valued at $1,724,887. The Natomas Co. operated six electrically driven dredges, equipped with 510 buckets with an hourly capacity of 340 cubic yards, at Natoma and vicinity the entire year. The company handled 14,901,143 cubic yards of material and, according to its printed annual report for the year ended December 31, 1930, the gross return per yard was 9.19 cents, the cost per yard 5.61 cents, and the net return 3.58 cents. The report further states:

> Comparing the 1930 operations with a previous 3-year average shows that the dredges handled 623,504 yards more in 1930. The gross return was 0.61 cent per yard greater; the operating costs decreased 0.17 cent per yard, and the net return per yard increased 0.78 cent. * * *
>
> The remaining proven ground, on latest estimates, should provide sufficient yardage to continue the operation of the present fleet of six dredges until 1940. The life of the dredges, however, might be extended by reason of prospecting operations now being conducted on new ground. If values in a sufficient area are found, the returns from dredging operations can be increased by adding a new dredge to the present fleet.

The average fineness of the gold produced in this region is high; the Natomas Co. gold was 0.9445 fine in 1930. To the gold output were added 77 ounces of platinum metals, including iridium and osmium. The Capital Dredging Co. controls over 885 acres of ground 5 miles south of Folsom. It operated three electrically driven dredges, two of which worked all of 1930; its No. 3 dredge began the first of August. These dredges handled 5,101,119 cubic yards of material. The State mineralogist, on page 12 of his annual report for 1925, describes the dredging ground in this district as extending from Blue Ravine, 6 miles above Folsom, along the present and former courses of the American River to 9 miles below Folsom and as 3 miles wide in places, with most of the payable gravel on the south side of the river. Both the present river and the ancient courses and terrace levels have been worked. The ground varies in depth from 20 to 70 feet.

Michigan Bar district.—Sluicing operations at the Ghezzi property in the Michigan Bar district yielded bullion valued at $327. The gold was 0.909 fine.

Walltown district.—Some pocket mining was reported in the vicinity of Walltown, the site of the early day placer-mining camp and stage station. On the ranches near Walltown several shafts have been sunk and a number of moderate size pockets found. The best of these was along a vein at the contact of a diabase dike and black slate. The gold output in 1930 from this foothill region was small, but bullion deposits at the banks in Sacramento indicate considerable activity by prospectors as this report is being written (June, 1931).

SAN BERNARDINO COUNTY

The value of the metals produced in San Bernardino County in 1930 was $244,610 compared with $252,253 in 1929. The output of gold and silver in the county increased, but that of copper and lead decreased; the total value of the silver was less than in 1929, due to the lower price of the metal. The county output includes the product of eight placers, amounting to $1,543 in gold and 7 ounces of silver. Excluding the output (11,493 tons of ore, $41,713 in gold, and 438,217 ounces of silver) of the Randsburg district, which is reviewed in the Randsburg district section under Kern County (see p. 995), the county produced from lode and placer properties $17,729 in gold, 25,408 ounces of silver, 34,029 pounds of copper, and 44,958 pounds of lead. Prior to 1894 statistics on the production of gold and silver only are available for the county.[19] The production of silver was greatly augmented by the discovery of a rich deposit at Randsburg in 1919, known as the Kelly or California Rand mine. Its total production has been approximately $16,000,000. For several years it was the largest single producer in the United States.

Black Hawk district.—The Arlington Mining Corporation continued the development of the Black Hawk-Santa Fe-Arlington group of claims 35 miles southeast of Victorville. The property is opened by about 12,000 feet of drifts, crosscuts, and raises, of which 1,500 feet were done in 1930. Mill tests have been made on low-grade gold ore in a pilot test plant; the completed flow sheet shows screening, crushing, amalgamation, and concentration equipment in a plant described [20] as containing a Hardinge mill, Dorr duplex classifier, amalgamation plates, Dorr thickener, 2 Plato tables, and cyanide plant. This pilot test plant was reported by the company as being equipped to treat 200 tons of ore a day and is expected to be in operation beginning in September, 1931.

Bristol Mountain district.—The Camp Castle mine in the Bristol Mountains 14 miles northeast of Amboy was operated by a lessee who produced a little gold, probably from cleanings, in the 10-ton Herman ball mill on the property. The mine is an old one, as the remains of old arrastres from former operations have been found in the gulch.[21]

Calico district.—The mines of the Calico district have a production record, according to the State mineralogist, of over $10,000,000 in silver.[22] Renewed mining activity in the district was caused by the Zenda Gold Mining Co., which shipped silver ore to a smelter in Utah. The mine is opened by two shafts 550 and 350 feet deep and by about 13 miles of tunnels, drifts, etc. The first 50-ton lot of ore shipped to the smelter averaged 67 ounces of silver and no gold. Plans were made to move the mill at Tehachapi Pass to the Zenda property, but the company ceased operations November 20 pending better silver prices. From the Burcham or Total Wreck mine about 85 tons of oxidized lead ore, containing some gold and silver and a small percentage of copper, were shipped to Utah. Development consists of a crosscut tunnel 500 feet long. This tunnel cuts the lead vein 125 feet from the portal, with a drift west on the vein of 1,300 feet and east of 200 feet.

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[19] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 203.

[20] State Mineralogist, Twenty-sixth Annual Report: 1930, pp. 222–226.

[21] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 230.

[22] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 203.

Coolgardie district.—At the Fractional placer claim 17 miles north of Barstow some gold 0.887 fine was produced by dry washing methods. About 500 yards of material were handled and yielded $151 in gold. The placers in the Coolgardie district have been worked [23] since 1900 by dry washers and concentration and are reported to have a production record of $100,000 to date.

Dale district.—In the Dale district development was started on several old properties, chiefly at the Supply and Virginia Dale mines. The Supply mine 15 miles east of Twenty-nine Palms is the most important mine in the district, and for many years it was a regular producer,[24] having yielded over $500,000; the ore contained principally gold and was treated by dry crushing and direct cyanidation in a mill of 100 tons capacity. The mine was operated in 1928 under lease and bond by the Arrowhead Development Co., of Nevada, for a short time. A little gold bullion was shipped by lessees in 1930. At the Virginia Dale property, comprising six claims, six men were employed remodeling the 40-ton cyanide plant and developing the mine. Three parallel veins [25] occur in quartz-diorite about 150 feet apart and range from 4 to 6 feet in width. The vein quartz is iron stained and is said to contain an average of $12 a ton in gold.

Goldstone district.—The Belmont Mining & Milling Co. owns 21 claims in the Goldstone district. Development work on these claims consists of a number of shafts sunk to depths of 50 to 300 feet on the different veins. The main shaft is 420 feet deep and is sunk on an incline of 35°. A test by cyanidation was made in 1930 on ore treated in a 20-ton rod mill. Prospectors worked a gravel deposit in the Goldstone district by dry washing methods and produced a little gold.

Grapevine district (Barstow, Daggett).—At the Bagdad Chase tailings dump one-half mile southwest of Barstow a total of about 30 tons of old tailings was treated by cyanidation and yielded $12.12 in gold and 0.17 ounce of silver to the ton. The tailings contained a little copper, which affected the recovery of gold. Ten tons of copper ore assaying $5.37 a ton in gold and 2.77 per cent of copper were shipped to a smelter from the Runover mine.

Holcomb district.—Some gravel was sluiced from the Bertha Peak drift prospect near Minnelusa, in the Holcomb district. Gold 0.940 fine was produced.

Ibex or Signal district.—The Copper Chief Mining & Industrial Co. shipped copper ore to Hayden, Ariz., from its property in the Ibex district. The ore carried about 1 ounce of silver and nearly $1 in gold to the ton and 3.3 per cent of copper. The mine is opened by an incline shaft 110 feet deep. The Denver and Colorado group of claims, recently located 13 miles south of Goffs, was developed by an incline shaft 100 feet deep and by 400 feet of drifting. Rich gold ore mined from the vein was treated by amalgamation. The Copper Buttes claims 15 miles southwest of Needles were developed;

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[23] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 232.
[24] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 254.
[25] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 259.

26 tons of oxidized copper ore, containing $1.90 in gold and 3.63 ounces of silver to the ton and 7.08 per cent of copper, was shipped to the smelter at Hayden, Ariz. Development consists of a 125-foot shaft and numerous short tunnels and opencuts.

Ivanpah Mountain Range region (*Cima*, *Ivanpah*).—From the New Trail Mining Co. property of 28 claims, on the east slope of the Ivanpah Range 11 miles northwest of Cima, 64 tons of sulphide ore were shipped to a Utah smelter. The ore contained $3 in gold and 3 ounces of silver to the ton and 12.5 per cent of copper. The development consists of a 2-compartment shaft, sunk 200 feet, and about 1,000 feet of drifts. The Colosseum Mines (Inc.), owning claims located in the north end of Clark Mountain, has developed the property by 800 feet of tunnel. The mill equipment consists of a 50-ton ball mill, Wilfley table, and Simpson flotation machine. The ore developed [26] in the tunnel and shaft is said to average $7 in gold to the ton and carries considerable iron pyrites. The mill was operated for 20 days in December, and 14 tons of concentrate were produced but not shipped.

Kelso district (*Providence Mountain*).—The Bonanza King mine in the Kelso district 25 miles west of Fenner produced silver-lead ore, containing about 158 ounces of silver to the ton, a little gold, and 6 per cent of lead, which was shipped in test lots to various smelters. The 50-ton flotation mill at the mine was not operated in 1930. The mine is opened to a depth of 600 feet. The Vulcan property produced 10 tons of siliceous gold ore which, treated by amalgamation in a 40-ton Herman ball mill, yielded 36.5 ounces of gold and 12 ounces of silver. The mine is opened to a depth of 400 feet and by 2,000 feet of drifts. The Frisco group of 5 claims 7 miles east of Hayden on the Union Pacific Railroad was under development. One ton of ore mined from the Frisco No. 3 claim was shipped to Midvale, Utah. The ore assayed 2.11 ounces of gold and 54 ounces of silver to the ton. The predominating formation in the district is diorite and dolomitic limestone. The gold-quartz veins occur in the diorite.[27] The property is opened by a number of tunnels 20 to 400 feet in length and shafts 20 to 100 feet in depth. The Gold King Mining Co., owner of a group of claims 16 miles south of Cima, produced sulphide concentrates in a 30-ton dry concentrating plant. The concentrates recovered contain 4.92 ounces of gold and 6 ounces of silver to the ton. The mine is at an elevation of 5,000 feet and is developed by a shaft 485 feet deep.

Lytle Creek district.—Some placer gold was produced with dry washing machines on Lytle Creek, which has its source on the east slope of Mt. San Antonio northwest of San Bernardino. The gold is chiefly in river terraces, which rise 150 feet or more above the valley bottom. The Eagle placer claims were worked by sluicing, and the gravel yielded gold 0.877 fine.

Monumental district.—From the property of the Copper Basin Mining Co. in the Monumental district 15 miles north of Parker, Ariz., 41 tons of 12.3 per cent copper ore, containing a little gold and silver, were shipped to a smelter in Arizona. Two well-defined zones of mineralization occur in quartz porphyry. The development work consists of opencuts, tunnels, and shallow shafts; one shaft is 100 feet deep and shows an 8-foot vein.[28]

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[26] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 232.
[27] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 235.

Ord Mountain district.—About $380 in gold 0.916 fine was produced by dry washing machines handling erosion material from the Camp Rock placer in the Ord Mountain district 26 miles southeast of Daggett. The material is put through a grizzly and elevated to a trommel, which discharges into a 50-foot sluice box. Bedrock, where exposed, is 15 to 25 feet below the surface. A well sunk to a depth of 210 feet on the property is reported[29] to yield 6 gallons of water a minute. The Maumee placer gravel deposit 38 miles northeast of Lucerne Valley post office was worked by dry washing methods and produced about $300 in gold 0.848 fine.

Randsburg district.—Producing mines in the eastern part of the Randsburg district lying in San Bernardino County, including the Uranium or California Rand Silver mine and the Wortley Consolidated mine, are reviewed in the Randsburg district section under Kern County (see p. 995).

Silver Mountain district.—The Sidewinder mine in the Silver Mountain district 13 miles east of Victorville was worked by the Tioga Co. (Ltd.), and a total of 600 tons of siliceous gold ore was treated by cyanidation in a small mill on the property. The mine is opened by a vertical shaft 640 feet deep and a tunnel 610 feet long.

Silver Reef district.—From the Lucky Jim mine in the Old Woman Mountains 20 miles north of Milligan 18 tons of silver ore containing 79 ounces of silver and $1 in gold to the ton and 3 per cent of copper were shipped to the Hayden smelter in Arizona. The ore is siliceous and accompanies a porphyritic dike in granite. The principal minerals in the ore are chlorides and bromides of silver and chalcopyrite.[30]

Vanderbilt district.—The Vanderbilt Mines Co. shipped sulphide ore, containing principally gold, some silver, and a little copper, from its property 4 miles east of Ivanpah. The mine is developed from the Gold Bar claim by an incline shaft 460 feet deep, 220 feet of which were done in 1930. Most of the ore was mined from the 200-foot level.

SAN DIEGO COUNTY

The value of the gold and silver produced from lode mining in San Diego County in 1930 was $2,244, an increase of nearly 75 per cent compared with 1929. Gold is the chief metal mined.

Dulzura district.—The Even Break mine in the Dulzura district produced gold 0.653 to 0.691 fine during the short time it was operated by the owner.

Julian district.—Five lode mines in the Julian district produced 267 tons of ore, all of which was treated by amalgamation in three mills in the district. The recovered bullion contained 66.93 ounces of gold and 13 ounces of silver valued together at $1,389, or an average of $5.20 for each ton of ore milled. A 2-stamp mill was operated by its owner on ore from the Eagle claim and the adjoining High Peak mine; development at these properties consisted of drifting, tunneling, and stoping ore. The Golden Chariot Mining Corporation carried on tests in its amalgamation-concentration mill, which is equipped with a 40-ton Rexman rod mill, two amalgamating plates, a Wilfley table, and a flotation machine. Some gold 0.748 fine was recovered by amalgamation from the ore tested. The mine is opened by a 200-foot vertical shaft, a 150-foot winze, and 1,500 feet of drifts. At the property of the North Hubbard Mining Co. about 50 tons of ore were tested in a 10-ton mill equipped with crusher, Marcy ball mill, and Wilfley concentrator. The mine is opened by a 300-foot crosscut tunnel to the vein; more recent work consists of sinking winzes to a shallow depth in the main drift.

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[28] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 207.
[29] State Mineralogist, Twenty-sixth Annual Report: 1930, pp. 230–231.
[30] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 279.

SAN LUIS OBISPO COUNTY

The value of the output of gold and silver from placer mining in San Luis Obispo County in 1930 was $1,462. The gravel of an ancient river channel 19 miles northwest of Paso Robles was worked for a short period and the material sluiced; the fine gold was saved in a Pierce amalgamator.

SHASTA COUNTY

The value of the metal output of Shasta County was $746,766 in 1930 compared with $1,182,655 in 1929; the marked decrease was due largely to the falling off in the quantity and value of copper. The largest producer in the county was The Mountain Copper Co. (Ltd.) in the Iron Mountain district. Placer or surface mining in various districts of the county resulted in an output of $56,415 in gold and 360 ounces of silver, valued together at $56,554; part of this gold was produced by prospectors working veins of lode mines as well as placers. One merchant alone handled 465 small lots of gold dust and bullion, valued in all at over $8,000, the individual amounts ranging from a minimum of 50 cents to a maximum of $100 and the principal individual amounts averaging around $25. The origin of these small purchases was chiefly the streams and gulches tributary to the Sacramento River, such as Clear Creek, Cottonwood Creek, Flat Creek, and Churn Creek, and various small districts.

Centerville district.—Gold ore from the Yankee John property, closed for about 10 years, was hauled to Buckeye and treated in a Gibson mill. A little gold bullion was produced at the Happy Choice claim from sorted ore ground in a hand muller and mortar. Both properties are opened by shafts 70 feet deep. Sluicing operations on ranch land yielded placer dust 0.906 fine.

Churntown district.—Ground sluicing of about 8,000 cubic yards of gravel from the Triangle placer in the Churntown district yielded gold dust 0.825 fine. This output and that of 10 small producers amounted to $4,151 in gold and 34 ounces of silver, valued together at $4,164. Miners were very active between January and March, when water was available.

Cottonwood Creek district.—A small dredge was moved late in the year to the mouth of Roaring River above Gas Point on Cottonwood

Creek. Some platinum metals were recovered with gold in pan tests of the gravel.

French Gulch district.—Eight lode mines and one placer in the French Gulch district produced 462 tons of ore, $5,075 in gold, 316 ounces of silver, and 76,937 pounds of copper, valued in all at $15,199. Most of the ore containing copper was from the Greenhorn mine, which closed early in the year on account of the low price of copper. This mine has a deposit of gossan ore partly developed and said to be amenable to cyanidation. Many lessees worked on different properties, sorting high-grade gold ore, where the gold is sometimes found concentrated into pockets and pocket shoots. The hand mortar was extensively used. A Huntington mill in Summit Gulch and a 2-stamp mill on the Hobo claim turned out gold bullion. The Sybil mine, an old producer, is opened by a 400-foot tunnel adit. Old workings above this tunnel were cleaned out, revealing a little rich ore which was ground in a hand mortar. On the East Fork of Clear Creek ground sluicing at the Stoddard Gulch claim resulted in a production of gold dust 0.900 fine in gold and 0.090 fine in silver.

Horsetown district.—The Shasta Butte Gold Dredging Co. worked about 750,000 cubic yards of gravel in 1930 on Clear Creek in the Horsetown district and produced gold 0.850 fine. The electric dredge of 3,200-cubic yard daily capacity was operated continuously until the first of August. This company also operated a dredge near Oroville in Butte County.

Iron Mountain district.—The Mountain Copper Co. (Ltd.) was the only important producer in the Iron Mountain district and ranked third in California in output of copper in 1930. It operated a 350-ton flotation mill part of the year on siliceous copper ore and a 550-ton cyanidation plant on ore from the gossan deposit. For many years the company was one of the principal producers of copper, with a smelter at Keswick; this smelter was dismantled, but the operation of the company's 350-ton smelter has since continued at Martinez, where sulphuric acid, fertilizer, gas purifier, and bluestone are produced from ores of the Iron Mountain mines. Recently the gossan above the old Iron Mountain sulphide ore body was found amenable to cyanidation; and although it averaged only $1.85 a ton in gold, a small profit was made. The lower horizon of the gossan was divided into 50-foot squares, and a composite surface sample assayed $2.40 a ton. The total quantity was estimated at 365,000 tons, averaging $2 a ton in gold, and 190,000 tons, averaging from $1.40 to $1.60. Roughly, the cost of mining and milling was 85 cents a ton in a plant treating about 500 tons of ore a day. In 1930 the mining of the gossan was done in an open pit with a Bucyrus Erie ¾-cubic yard electric shovel with caterpillar drive. Ore was loaded on Mack trucks hauling 8 tons to the load. The haul is 2,200 feet, and three trucks and three drivers are required. Work in the pit was handled by three quarrymen and one shovel man. The ore is dumped over a 9-inch grizzly into a receiving bin, which feeds to a 2-inch grizzly. Undersize passes with crusher product to 40 by 15 inch rolls of the Anaconda type, thence to ½-inch mesh wire screens, to ½-inch-mesh Link Belt vibrating screens, and to Cornish rolls of the Joshua Hendy type. Ten vats, 26 by 12 feet each, hold 276 tons. Precipitation is effected in a 400-ton Merrill-Crowe precipitation plant. A Deister-Overstrom table is used for cleaning refinery slags. Further details of mining costs, with milling data, are given by the State mineralogist.[31] In addition to the cyanide plant at Iron Mountain, the company has a flotation mill for siliceous copper ore. The company also produced iron pyrites from the Hornet mine. The flotation mill is equipped with 2 gyratory crushers (a No. 6 K Gates and a No. 4 McCully), 2 revolving trommels, 2 Allis Chalmers ball mills, 2 Dorr hydraulic classifiers, 16 Minerals Separation 24-inch machines, an 11½ by 6 foot Oliver filter, and a 30 by 7 foot Dorr thickener. The flotation mill was closed and no concentrates were produced after October. Some copper concentrates were still in storage at the close of the year. Some of the pyrite was sold to other chemical plants for the manufacture of acid, and the residue was returned to Martinez for leaching. Cement copper leached from the residue of the roasted pyrite was made at Martinez, and copper from mine water was produced at Iron Mountain.

Quartz Hill district.—A small lot of siliceous ore from the Gold King property 3 miles northwest of Redding was hand mortared and yielded a little gold bullion.

Shasta and Flat Creek district.—Twenty-three producers of gold operating on surface and placer properties sold small lots of gold dust and bullion to merchants. In addition, the Crystal and Scottish Chief lode claims yielded gold ore treated in a Huntington mill. The total output of the Shasta and Flat Creek district in 1930 amounted to $4,971 in gold and 47 ounces of silver. Reports were received from the Elizabeth gravel mine near Shasta and the North Star placer on Flat Creek. The gold of the North Star claim was 0.920 fine.

Stella (*Whiskeytown*) *district.*—Nine placers in the Stella district produced gold and silver valued at $3,768. Most of the gold was recovered from Clear Creek by rockers and sluicing. Merchants in the vicinity and the banks at Redding purchased the gold dust or bullion from the region for deposit at the San Francisco Mint. Among the surface mines operated was the Little Ben placer about 3½ miles from Schilling. Four lode mines produced 166 tons of siliceous ore yielding gold and silver valued at $4,074. Lessees were busy in the seam diggings of the Mad Ox and Mad Mule, which yielded rich gold quartz; the gold was recovered in hand mortars. The mine and Huntington mill of the Betty May Gold Mines (Inc.) were operated. The mine is opened by an incline shaft 150 feet deep.

SIERRA COUNTY

The value of the metals (gold and silver) produced in Sierra County increased from $369,179 in 1929 to $591,305 in 1930. This decided increase was largely in the gold yield, which showed a gain of $201,835 from lodes and $20,018 from placers.

Alleghany (*Forest*) *district.*—Nine lode and 15 placer operations in the Alleghany district produced $517,088 in gold and 4,583 ounces of silver, valued together at $518,852. The average value of the ore in gold and silver in 1930 was $11.37 a ton. The principal mine in the district is the famous Original Sixteen to One, an old producer of high-grade gold ore. The company was reported to be planning the treatment of the low-grade ore in connection with deeper mine development. The mine is opened by two incline shafts 1,300 and 2,100 feet deep. The high-grade ore is ground and amalgamated in Berden pans; the medium-grade ore is crushed by stamps, amalgamated, and concentrated; and the concentrates and pan tailings are shipped to a smelter. Important operations were carried on and development work was done at the Brush Creek mine near Goodyears Bar by the Kate Hardy Mining Co., which operated a 15-stamp amalgamation mill continuously and produced bullion averaging 0.813 fine in gold. The mine is opened by a vertical shaft 300 feet deep and has 2,200 feet of tunnel. Kanaka Creek mill tailings were reworked in an arrastre by amalgamation for the free gold not recovered by earlier mill operations; the arrastre was operated by water power. The Eldorado claim, a pocket mine, yielded some gold. The Bonanza King also yielded high-grade ore by pocket mining. The Oriental mine was rehabilitated, and production of bullion began in December. About 500 tons of ore were treated in the 10-stamp amalgamation mill. The mine is opened by an incline shaft 1,300 feet deep and by 4,800 feet of crosscut tunnel. At the Oro Flame mine more than 2,000 tons of rock were mined, but less than a ton of ore yielded the bullion 0.852 fine in gold that was shipped to the San Francisco Mint. A large part of the placer gold produced in the district was from the property of the Kirkpatrick Mines Co., at Goodyears Bar. Bullion 0.884 fine in gold was produced during assessment work on the Mammoth placer claim, and gold of about the same fineness was placered from the Oregon Creek and Kanaka Creek placers. The Ruby placer property of the Anglo Pacific Mines (Ltd.) was under investigation; a little gold was recovered.

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[31] State Mineralogist, Twenty-seventh Annual Report: 1931, pp. 129–138.

Downieville district.—At the Elcy quartz mine about 200 feet of development were done in 1930; the 5-stamp amalgamation mill reduced about 200 tons of gold ore yielding 150 ounces of bullion 0.782 fine in gold. The mine is opened by a 70-foot vertical shaft and 700 feet of tunnel work. From the property of the City of Six Mining Co. 240 pounds of high-grade material had a net value of $1,803. The property is developed by two tunnels 2,000 and 900 feet long and by several raises. The Finney mine of the Gruss Mining Co. produced some ore yielding gold by amalgamation. Loose ledge material was ground-sluiced from the Ironsides quartz property. At the Eleanor hydraulic on Goodyear Creek a little gold was produced. The Mary Jane placer on the North Fork of the Yuba River produced about 20 ounces of bullion 0.889 fine in gold. Some drifting was done at the Rattlesnake Peak placer in Clark's Canyon, and a little gold was produced.

Indian Hill district.—Three placer properties in the Indian Hill district produced gold, all of which averaged close to 0.924 in fineness. The Depot Hill hydraulic property 5 miles northeast of Camptonville was the principal producer.

Port Wine, Gibsonville, Table Rock district.—The Last Chance drift placer in the Table Rock country 9½ miles east of La Porte produced gold 0.903 fine between May and September. The Brown placer, also near La Porte, was worked with two giants supplied by 400 inches of water under 110-foot pressure. About 18,700 cubic yards of material were handled between March and June. A small lot of placer gold 0.863 fine was produced from the Howland placers. The Mines Operating Corporation (Ltd.) worked the Wehrle No. 1 placer with two hydraulic giants with 1,000 miner's inches of water under 185-foot pressure, handling about 50,000 cubic yards of material between March and June. The company controls approximately 1,500 acres of land and has 25 miles of ditches.

Sierra City district.—Three lode mines and three placers in the Sierra City district produced 3,705 tons of ore, $38,787 in gold, and 560 ounces of silver, valued together at $39,003. The ore averaged $10.25 in metals a ton and was all treated in gold and silver mills by amalgamation. The Sacred Mound or California Buttes, an old mine, was the chief producer of gold in the district. It is opened by a crosscut tunnel 700 feet long and 300 feet of drifts and is equipped with a 10-stamp amalgamation-concentration mill. Gold bullion and sulphide concentrates were shipped during the operation of the property, which was later closed on account of litigation. Some gold was recovered by amalgamation from 275 tons of ore mined from the Four Hills mine and from about 400 tons of ore produced by lessees from the Primrose property. The Paramount drift placer near Sierra City was actively developed with two No. 3 giants washing off overburden, and preparations were made for extending the pipe lines. About 16,000 cubic yards of gravel were treated between April and July, and gold 0.873 fine was produced.

SISKIYOU COUNTY

The total value of the metals recovered from 107 placer operations and 21 quartz mines in Siskiyou County was $127,290 in 1930, compared with $70,751 in 1929.

The actual auriferous area of Siskiyou County is small but is scattered over practically the western three-fifths of the county; this area has a population estimated roughly from the late census at 13,900,[32] of whom about 1,500 make a living at mining. There are only six quartz mining districts, but placers are widely scattered and can not be so closely grouped. For convenience in making the following review of the metal production of the county, the mineralized area is divided into the Elliott Creek, Klamath River, North Central, Salmon River, and Scott River regions. The geological features of these regions are discussed in the report of the State mineralogist[33] for 1925.

Elliott Creek region.—Two lode mines and one placer in the Elliott Creek region produced copper ore and gold bullion yielding metals valued at $61,356. From January to June copper ore from the Blue Ledge mine of the Consolidated Copper Mining Co. was hauled by truck 39 miles over an improved road, following the Big Applegate River, to the railroad at Medford, Oreg., and daily shipments were made to the Tacoma smelter. The ore averaged about $1.80 in gold and 4 ounces of silver to the ton and nearly 9 per cent of copper. The mine is opened by a vertical shaft, 9 tunnels and drifts, and 6,000 feet of crosscuts, raises, and winzes. Heavy shipments were made during the World War and until suspension of activities in

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[32] Supervisor of Census at Redding.

[33] State Mineralogist, Twenty-first Annual Report: 1925, pp. 415–420.

October, 1920; after that time the mine was idle until it was transferred to the present company.[34] The Blue Channel placers were worked by Joe and Henry Slotik, and the Pennsylvania placers by the Fawcett Mines Co. The placers may be reached from Medford, Oreg., by way of Joe Bar, a distance of 50 miles, or from Gottville, Calif., 30 miles by road and trail to the head of Elliott Creek. The history and description of the placers are given in a recent report,[35] which mentions the channel on the Hope claim as yielding $1,200 in 1930.

Klamath River region.—In 1930 the output of metals from 12 placer operations and 5 quartz mines in the Klamath River region amounted to $20,004 in gold and 143 ounces of silver. Of this total $16,930 in gold and 119 ounces of silver were recovered from ore treated at gold and silver mills by amalgamation, chiefly at Happy Camp; the remainder, $3,074 in gold and 24 ounces of silver, was from placers of the Klamath River from the mouth of Humbug Creek west for a distance of about 100 miles. The placers at Oak Bar produced $1,324 in gold and 11 ounces of silver and at Seiad Valley, $404 in gold and 4 ounces of silver; the Hickox placers in the vicinity of Cottage Grove also yielded some gold. The methods of gold recovery employed at the placers were ground sluicing and hydraulicking.

The Buzzard Hill Mines (Inc.) developed some ore in its quartz property south of Happy Camp. The mine is opened by 1,000 feet of drifts and raises and has a 3½-foot Huntington mill. About 295 tons of ore were treated by amalgamation and yielded 104 ounces of gold 0.784 fine; the tailings were held for further treatment. The Independence mine in the vicinity of the Buzzard was also operated by the Buzzard Hill Mines (Inc.), which did 210 feet of drifting and sank the shaft an additional 50 feet to a depth of 200 feet. The ore is siliceous and the gold free, with a very small silver content. About 1,000 tons were treated in a 10-stamp amalgamation-gravity concentration mill and yielded 558.65 ounces of gold 0.896 to 0.906 fine; the concentrates saved from the ore were not of sufficient value to ship, and in the future the tailings may be treated by cyanide.

North Central region.—Seven lode mines and 22 placer operations in the North Central region produced $19,724 in gold and 150 ounces of silver. Of this total the quartz mines produced $8,166 in gold and 67 ounces of silver, chiefly from the Deadwood district, and the placers produced $11,558 in gold and 83 ounces of silver, chiefly from the Cottonwood district, including the Tony Lund placers on the Klamath River a short distance below the mouth of Humbug Creek. The gravel deposit of the Tony Lund was worked to a depth of about 50 feet by the H. C. Benson Co. with a power shovel until May. An inclined skip way was constructed to deliver the gravel to an elevated sluice built near the edge of the gravel pit; but this method was found too expensive, and several sets of lessees continued to work by drift mining. Included in the total is gold produced from the Blue Gravel mine on the Klamath River at Rancheria Creek, the Ironsides on Ash Creek, and the Flat Bar on Hungry Creek near Hilts, and from Modoc Gulch off from Shasta River.

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[34] The Mines Handbook, vol. 18, Suffern, N. Y., 1931, p. 532.
[35] State Mineralogist, Twenty-seventh Annual Report: 1931, p. 56.

Several gold dredges have been operated in the vicinity of Yreka, but no dredging was done in 1930. The hull for a dredge was completed by the Gardella interests on the Steele Ranch in the Greenhorn district, near the site of the El Oro No. 3 dredge which was operated until the ground was worked out in 1920. The new dredge is expected to be completed late in 1931.

The Fidelity Metals Corporation developed the Schroeder mine in the Deadwood district by cleaning out and retimbering a 2,000-foot adit on the Snowflake vein. The vein is chiefly shattered quartz heavily stained with iron oxide and is said[36] to average $8.80 a ton in gold. Some gold was recovered in a 10-stamp amalgamation mill, which operated 45 days. From the Gilt Edge mine on Cherry Hill, opened by a 200-foot tunnel, ore was hauled on horse-drawn sleds to a 4-stamp amalgamation mill. The placers of the Cottonwood district, including Rancheria Creek, are estimated[37] to have yielded about $4,000,000. The conglomerate in the Blue Gravel mine, which was worked previous to 1930, yielded 60 cents a square foot of bedrock when hydraulicked; this represented only a part of the gold content, however, due to loss in the unbroken masses of conglomerate passing over the dump. The portion next to bedrock, when worked in an arrastre, paid 88 cents a square foot of bedrock. The conglomerate is overlain by Cretaceous sediments. These and other notes[38] in the State mineralogist's reports are of value in prospecting the Cottonwood area. The best-known mine in this entire region is the Morrison and Carlock in Quartz Valley, at which some development work was done in 1930.

Salmon River region.—Six lode mines and 36 placer operations in the Salmon River region produced $19,095 in gold and 156 ounces of silver. The region embraces the drainage of the Salmon River, an area of about 800 square miles, and includes many formerly productive quartz mines and placer deposits, the latter worked in more recent years almost entirely by the hydraulic process. Water was scarce in 1930, and the region ranked second to the Klamath River region in production of gold. The output of mines in the vicinity of Sawyers Bar or the Liberty district was the largest, amounting to $13,609 in gold and 97 ounces of silver. The Forks of Salmon district was credited with $5,077 in gold and 56 ounces of silver. Among the chief producers in the region was the Gallia Placer Mining Co. (Inc.) which, with hydraulic equipment consisting of three giants, one elevator, and one derrick, 5 miles below Sawyers Bar, handled about 21,000 cubic yards of gravel during 1930 and produced 133 ounces of gold 0.833 to 0.872 fine. At the Muir placer in Eddys Gulch gold 0.845 to 0.861 fine was recovered from 17,000 cubic yards of gravel by hydraulic mining with one giant supplied with 2,880 miner's inches of water under 255-foot pressure. The Summerville placer on the South Fork of the Salmon River was worked from March 1 through July, with five giants supplied with 2,000 miner's inches of water under 200-foot pressure, and produced gold 0.856 fine. The Orcutt placer mine at the mouth of Methodist Creek 7 miles by trail southeast of Forks of Salmon has been hydraulicked by the owner on a small scale for many years. Loose bar and bench gravels 10 to 20 feet deep and 300 feet wide are worked with one small giant supplied with water from Methodist Creek for a season not exceeding six months.[39] Most of the gold recovered by prospectors "mossing on the Salmon River" was sold to merchants in the neighborhood. This process consists of catching the fine gold in the moss at low water, drying the moss, burning it, and recovering the gold from the ashes.

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[36] State Mineralogist, Twenty-seventh Annual Report: 1931, p. 53.
[37] State Mineralogist, Twenty-first Annual Report: 1925, p. 417.
[38] State Mineralogist, Twelfth Annual Report: 1894, pp. 459-471.

Scott River region (*Scott Bar*, *Callahan*).—Thirty-six placers and one lode mine in the Scott River region produced $6,912 in gold and 67 ounces of silver. Most of the placer production in the district is from the bed and bars of the South Fork of Scott River. Some disintegrated gold-bearing schist was sluiced from the Virginia lode mine, which is equipped with a 5-stamp mill run by water power. The shortage of water permitted operations only from March until June, and it was planned to install an engine in the mill to replace the water power for the treatment of 1,000 tons of ore reported in sight. No production was reported from the McKeen mine, although the mill was operated for 10 days in 1929 by the Oro Grande Mining Co.[40] and treated 400 tons of ore. The mill has a Blake crusher, Hardinge ball mill, Dorr classifier, two 10-foot amalgamating plates, and a K & K flotation machine. The mill is of 35-ton capacity, and the ore is crushed to pass a 60-mesh screen. The Quartz Hill mine near Scott Bar has been the most productive property in the Scott River region, but in 1930 the output was less than in former years. The property is described in a recent report [41] of the State mineralogist as follows:

> In 1860, or earlier, the mine was started as a hydraulic mine working on material eroded from the large system of quartz veins now exposed. A small mill of 10 stamps of 750 pounds each was used in some of this early work, with amalgamation for the recovery of the gold. Present operators have worked the deposit for 25 years. Three or four men blast the hard quartz and schist and then hydraulic this broken material. Giants, discharging a large volume of water at a high pressure, wash the broken rock through a regular sluice with riffles in the bottom to catch the gold. The face of the pit is examined after each blast; and if any high grade is found, it is sorted out and crushed in a small ball mill, run by a 5 horsepower air motor and equipped with amalgamating plates.

STANISLAUS COUNTY

The gold and silver produced in Stanislaus County in 1930 were valued at $109,342 and came entirely from placer operations, chiefly by dredging.

Knights Ferry district.—The Bullfrog placer on the Stanislaus River 11 miles east of Oakdale produced in 1930 from test runs of gravel. One 500-cubic yard electric dragline excavator was operated during November, when about 2,000 cubic yards of material were sluiced. The operations are on the ranch of the Willms Land & Cattle Co. In addition to the gold produced by ground sluicing, the Atlas Rock Co. recovered about $3,000 in gold as a by-product of its gravel-crushing plant near Oakdale.

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[39] State Mineralogist, Twenty-first Annual Report: 1925, p. 482.
[40] State Mineralogist, Twenty-seventh Annual Report: 1931, p. 48.
[41] State Mineralogist, Twenty-seventh Annual Report: 1931, p. 49.

La Grange district.—The La Grange Gold Dredging Co. produced bullion 0.794 to 0.895 fine in gold from 1,634,000 cubic yards of material worked by an electrically operated dredge with seventy-six 10½-cubic foot buckets. The dredging ground is on the Tuolumne River 4 miles west of La Grange. Some platinum metals, in addition to the gold, were recovered. Prospectors working a drift mine 1 mile west of La Grange produced gold 0.927 fine.

TRINITY COUNTY

Trinity County mines in 1930 produced 16,016 tons of ore and old tailings, $330,003 in gold, 17,403 ounces of silver, and 588,574 pounds of copper, valued in all at $413,218, compared with $470,640 in 1929. Decreases were recorded in both quantity and value of each metal.

Carrville district.—A total of about 2,000 tons of old tailings from the Strode property was treated by cyanidation. A little gold was recovered by amalgamation from ore produced from the Dunmovin prospect.

Coffee Creek district.—Three placers and two lode mines in the Coffee Creek district produced 11 tons of ore, $2,768 in gold, and 25 ounces of silver. The Nash placer on upper Coffee Creek was the principal producer of gold in the district; but due to shortage of water, operations were carried on only from May until September. A dragline excavator and steam shovel were used in handling the gravel. The Prince Albert and Watson placers each produced gold averaging about 0.847 fine. A little gold 0.812 fine was produced at the Packers mine, which is equipped with an amalgamation mill; the mine is in Packers Gulch 17 miles from Coffee. At the Holland mine, where the Seymour Placer Gold Mines (Ltd.) had installed considerable equipment in 1928–29, about 50,000 cubic yards of gravel were washed during the season of 1929–30. The clean-up[42] was apparently disappointing, as no production was reported.

Dedrick district.—The Betty Hibbard Mining Co. produced a little gold from ore treated in a 5-stamp amalgamation mill at the Mason and Thayer property on Canyon Creek. The Oswald placer, which extends along the Big East Fork of Canyon Creek, was hydraulicked. The bullion, 0.889 fine in gold, was sold to the San Francisco Mint.

Douglas City (*Indian Creek*) *district.*—The Redding Creek Placers (Ltd.) tested its ground in the Indian Creek district in various places and hydraulicked 30,000 cubic yards of material between February and May. The bullion recovered amounted to 342 ounces and ranged from 0.885 to 0.898 fine in gold. The company controls about 1,600 acres of placer ground which is supplied with water carried through 2½ miles of flume. The Steiners Flat placer, worked by hydraulic mining with two giants, produced some gold 0.911 fine.

Eastman Gulch district.—The Paymaster quartz property in the Eastman Gulch district near Lewiston was operated until November. A 20-ton mill equipped with two 800-pound stamps, a Straub ball mill, and an Overstrom table was completed in 1930 and treated 450 tons of gold ore yielding bullion recovered on amalgamating plates amounting to 225 ounces, averaging 0.739 fine in gold and 0.243 fine in silver, and 5 tons of sulphide concentrates containing 3 to 14 ounces of gold to the ton. The concentrates, with 6 tons of crude ore containing 1.39 to 6.10 ounces of gold to the ton, were shipped to a smelter.

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[42] State Mineralogist, Twenty-seventh Annual Report: 1931, p. 58.

Forest Glen district.—The Little Klondyke Consolidated placer on the South Fork of the Trinity River 5 miles northwest of Forest Glen was operated a month, and a little gold 0.889 fine was produced. The property consists of 160 acres of placer ground, with 1,000 feet of flume and 500 feet of pipe for hydraulic mining.

Hayfork district.—Four placers and one lode mine in the Hayfork district produced 12 tons of ore, $1,294 in gold, and 10 ounces of silver. The ore was produced from the Mueller property, at which the amalgamation-gravity concentration plant was in operation a short time. The mine is opened by a 25-foot shallow shaft and 380 feet of drifts. At the Nugget Bar placer on Hayfork Creek a little gold 0.875 fine was produced. Miscellaneous small lots of placer dust were purchased by merchants.

Helena and East Fork district.—The North Fork Placers (Inc.), owning placer ground at the junction of the Trinity River and the North Fork, was the principal producer in the Helena district. About 426,500 cubic yards of material were handled with two No. 5 giants operating between January 1 and August 1. The gold produced was 0.876 fine. The company is reported to have invested $276,000 in building its flume to bring water from the North Fork of the Trinity River to the mining ground. The clean-ups were disappointing to the company, and the ground was leased to seven of the employees. The Enterprise quartz mine in the East Fork district was operated by the Chiksan Oil Co. The mine is opened by a 2,000-foot tunnel in which 350 feet of drifts and 100 feet of raises were done in 1930. The property is equipped with a 10-stamp amalgamation mill.

Horseshoe district.—The Island Copper Co. shipped from its property in the Horseshoe district to the Tacoma smelter 12,738 tons of copper ore containing 702 ounces of gold, 15,251 ounces of silver, and 604,518 pounds of copper. The ore contains pyrite, pyrrhotite, chalcopyrite, and a little sphalerite. The property is developed by over 3,000 feet of workings, opening [43] up 300,000 tons of ore.

Junction City district.—The Madrona Dredging Co. (Ltd.), controlling about 1,500 acres of placer ground in the Junction City district, produced 2,694.56 ounces of bullion (averaging 0.792 fine in gold) and platinum metals consisting of platinum, iridium, ruthenium, and osmium. The electrically operated dredge, with 72 buckets of 9-cubic foot capacity each, is of sluice type and leaves ground worked over practically level. In 1930 it handled 3,750 cubic yards a day, or a total of 1,030,000 yards.

Lewiston district.—Two dredges on the Trinity River above Lewiston and miscellaneous small producers yielded $209.559 in gold and 1,477 ounces of silver. The Trinity Dredging Co. was the principal producer of gold; it treated 1,821.320 cubic yards of material with one electrically operated dredge of 3,000 cubic yards daily capacity and produced gold averaging 0.837 fine. The dredge has 42 buckets, each of 11-cubic foot capacity, and was operated continuously during 1930. In August, 3 miles above the Trinity dredge, the Placer Development Co. (Ltd.) took over the Lewiston dredge which had been operated the first part of the year by the Requa interests. The dredge on this property has 68 buckets, each of 7½-cubic foot capacity, and is electrically operated. The boat was in continuous operation and handled 854,630 cubic yards of material in 1930. At the placer property of the Gold Bar Mining Co. lessees were at work and succeeded in producing some gold. The equipment consists of two hydraulic giants, flumes, and pipe lines for handling 1,000 cubic yards of material a day.

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[43] The Mines Handbook, vol. 18, Suffern, N. Y., 1931, p. 588.

Minersville district.—At the Gold Leaf mine about 30 tons of gold ore were treated in an arrastre, and yielded gold 0.913 fine. The property is opened by a vertical shaft 60 feet deep and a tunnel 200 feet long.

New River district.—The New River Mining & Development Co., controlling 31 placer claims near Denny in the New River district, was getting its property ready for production. Some gold 0.800 fine was produced from the Mountain Boomer quartz property.

Salyer district.—The Salyer Consolidated Mines Co., owning placer ground at the junction of the Trinity River and the South Fork, continued to develop its property and expected to have it producing soon. About $500,000 has been spent in developing and equipping the property.

Trinity Center district.—The Five Pines group, under development, produced ore which was treated by amalgamation in a 2-stamp mill. The bullion, 0.847 fine in gold, was shipped to the San Francisco Mint.

Trinity River district.—From the operations of about 55 miscellaneous prospectors and miners on the Trinity River $7,837 in gold and 47 ounces of silver were produced. Some gold bullion sold to refiners contained platinum metals.

Weaverville district.—Nine placer properties in the Weaverville district yielded $11,591 in gold and 58 ounces of silver. The chief producer was the Red Hill or Jacobs placer, worked by hydraulic mining between February and June; the gold produced averaged about 0.911 fine. Hydraulic mining was also carried on at the Hook and Ladder, O & T, Rex, Testy Racetrack, and Potilla properties.

TULARE COUNTY

The mine production of metals in Tulare County in 1930 was valued at $363, with the chief value in silver. No production was reported from the county for 1929.

The Sequoia lead-silver prospect at Mineralking about 40 miles easterly from Lemoncove, a shipping station on the Visalia Electric Railway, produced oxidized lead-silver ore. The property is opened by shallow workings and was operated about four months.

TUOLUMNE COUNTY

A general decrease in the output of metals was reported from Tuolumne County for 1930. The total value of the metals produced decreased from $88,211 in 1929 to $68,598 in 1930. The output came from the mines of the Mother Lode, the mines on the "East

Belt," and from one mine on the Foothill copper belt. Most of the gold and silver were from the mines of the Mother Lode, which crosses Tuolumne County from Stanislaus River at Robinson's Ferry, through Whiskey Hill 1 mile west of Jamestown, through Quartz Mountain and Stent, and thence southeast along the east side of Woods Creek and Tuolumne River into Mariposa County. The East Belt mines are a short distance to the east of and as a group nearly parallel to the Mother Lode. Between the East Belt and the Mother Lode is a group of pocket mines near Sonora and Columbia, estimated as having produced metals valued at $5,500,000 and all of which continue to yield small amounts. This output has come principally from the Bonanza mine, Jackass Hill mines, Sugarman mine, and Colby property. Ten mines of the Mother Lode are estimated to have produced $30,390,000, according to the report[44] of the State mineralogist for 1928. These mines, named in order of output, are as follows: App-Heslep, Rawhide, Eagle Shawmut, Jumper, Dutch-Sweeney, Harvard, Santa Ysabel, Alabama, Clio, and Crystalline. The East Belt mines, 15 or more in number, have produced $20,620,000, chiefly from the Soulsby, Black Oak, Confidence, Grizzly, Gilson, Draper, Providence, Buchanan, Excelsior, Hunter, Keltz, Spring Gulch, New Albany, Green, and Experimental. Miscellaneous mines in outlying sections of the county were the Golden Gate, Patterson, and McCormick, with an estimated production of $2,010,000. Among the more important placer mines was the Springfield property in the Columbia region. The shallow placers of the Columbia and Springfield districts are commonly claimed to have produced $55,000,000 in gold bullion, as indicated by express company records. The other districts of the county are credited with a placer output of $101,000,000; of these the most important were: Groveland, Deer Flat, and Big Oak Flat, credited with $25,000,000; Sonora, with $11,000,000; Don Pedro Bar, Jacksonville, and Stevens Bar, with $9,000,000; and Gold Springs and Nigger Gulch, with $7,500,000. In recent years the placer production has been small; the value of the output was $1,568 in 1930 compared with $1,824 in 1929. Each district mentioned in the following review of Tuolumne County has had some placer production.

Columbia (*Shaw's Flat*, *Springfield*, *Bald Mountain*, *Sonora*) *district*.—Thirty-one mines and prospects, including placers, in the Columbia and outlying districts produced 311 tons of ore, $42,500 in gold, 176 ounces of silver, and 107 pounds of copper, valued in all at $42,582. The ore had a value of $134.91 a ton in gold and silver. The average value of the ore in gold appears high as much of the gold is reported by producers who show little or no ore due to the pockety character of some deposits. Usually the native gold mass has surrounding vein matter valuable enough to be treated in a stamp mill or hauled to a custom plant where the miners handle their own product. Small lots of free gold ore are also reduced in hand mortars. The principal part of the district output came from the Sugarman mine, which was operated until October. This is a pocket mine, and on account of the richness of the ore very little milling is required. The property is equipped with a 5-ton amalgamation mill, which treated on an average about 4 tons of ore a day on a schedule of about 5 days a month. The mine is opened by an incline shaft 680 feet deep, with 500 feet of drifts on the 250-foot level and 500 feet of drifts on the 380-foot level. Pocket gold was also mined from the Aetna, Lazar, and Mexican Springhill properties. The Sonnet Extension mine at Columbia is equipped with a 5-stamp amalgamation-gravity concentration mill, in which some sulphide ore was concentrated. The concentrates, with crude ore, were shipped to a smelter. The property is opened by a tunnel 300 feet long and a 100-foot winze sunk from the tunnel level. In the Shaw's Flat section the Faxon vein, worked by a lessee, yielded 422 ounces of gold 0.920 fine, including the gold recovered from 6 tons of ore treated at the Rawhide mill in the Jamestown district. The property is opened by a shaft 150 feet deep and has 80 feet of drifts. This is strictly a pocket mine, and the vein carries no value except where the pockets are found.

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[44] State Mineralogist, Twenty-fourth Annual Report: 1928, p. 9.

East Belt section.—Most of the mines in the so-called East Belt region lie east of the Mother Lode section and are scattered over a large area in the granodiorite and Calaveras formations. The mines in the East Belt region in 1930 produced 751 tons of ore and old tailings, $6,543 in gold, and 124 ounces of silver, valued together at $6,591, or $8.78 a ton. The Red Cloud and two prospects near Confidence produced gold and silver bullion recovered from ore treated in hand mortars. The Soulsby property at Soulsbyville yielded gold 0.786 fine from bullion recovered by amalgamation. The property shipped 1½ tons of sulphide concentrates, reduced from 20 tons of ore and valued at $57 a ton in gold and silver. In the Big Oak Flat district and near Groveland the ore produced yielded $3,843 in gold and 57 ounces of silver. The Longfellow mine near Groveland was the principal producer of gold, from about 400 tons of ore treated in a 10-stamp mill equipped with ten 800-pound stamps; the bullion produced was 0.670 fine in gold. The Lumsden or Croesus, a pocket mine, yielded some leaf gold, averaging over 0.900 fine, which was sold to specimen collectors and to the San Francisco Mint. Other producers were the Arizona, Eureka, Mohrman, Red Jacket, Silken, and Tip Top properties, all of them pocket mines. The United Mines Development Association of Nevada recovered about 75 ounces of gold from Buchanan tailings. The total output of the Buchanan mine since the beginning of operations is estimated[45] at $600,000 in gold and silver.

Goodwin Dam district.—During a short season of operation miners reported gold from drift mining on claims on the east side of Stanislaus River in the vicinity of Goodwin Dam and in Stanislaus Canyon adjacent to Table Mountain. Gold averaging about 0.906 fine was recovered from the gravel of the Jackass claims and Twin Pines; the latter was worked with a hand hoist and a 3-inch centrifugal pump operated by a Ford automobile engine. Operations of similar character were carried on on the Stanislaus River in the vicinity of Knights Ferry in Stanislaus County.

Mother Lode region.—Twelve quartz mines and five placer operations in the Mother Lode region in Tuolumne County produced 4,135 tons of ore and old tailings, $17,833 in gold, and 234 ounces of silver, valued together at $17,923. The ore and old tailings averaged

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[45] State Mineralogist, Twenty fourth Annual Report: 1928, p. 9.

$4.20 in metals a ton. Most of the ore was treated in amalgamation mills, but a total of 1,000 tons of old tailings was cyanided. The Mother Lode Extension Mines Co. was the most important producer in the Mother Lode belt. Its property, the " 55 mine," is in the New Years district near the Mariposa County line. About 400 tons of ore were treated in a 5-stamp amalgamation-gravity concentration mill and yielded bullion valued at $6,095. The mine is opened by a vertical shaft 140 feet deep and by 140 feet of drifts. Gold bullion was recovered by cyanidation from about 1,000 tons of old tailings from the Rawhide stamp mill. At the Valpone mine tests made on 100 tons of ore resulted in the production of gold bullion and about 1½ tons of sulphide concentrates containing about $165 in gold to the ton. Gold recovery near Jacksonville resulted from the working over of about 2,500 tons of old dump material by amalgamation in a 6-foot Bryan roller mill at the Willeta property. The material was handled with a dragline scraper rejecting waste over screens. Most of the ore produced in the Tuttletown district was of milling grade; it came chiefly from the Patterson mine one-quarter mile west of Tuttletown. About 200 tons of ore were treated in a 5-stamp mill, resulting in the production of gold 0.718 fine and of 12 tons of concentrates assaying $82.67 in gold and silver to the ton. The concentrates were not shipped. Other producers of small lots of ore recovered gold in hand mortars; among them were the Atlas, Cardinal, Norwegian, and Pine Tree properties, all pocket mines.

Oak Hill district.—After closing its property the Oak Hill Gold Mining Co. near Cooperstown shipped 47 tons of copper ore containing silver and gold to a smelter. The property[46] like many others in the Foothill copper belt, was first worked as a gold mine, the upper oxidized portion paying well to a depth of about 100 feet. where copper sulphide was found.

VENTURA COUNTY

A production of gold and silver valued at $223 was reported from Ventura County in 1930 compared with $476 in 1929. The Castaic Mines (Inc.) operated a property in the Snowy district near Piru and produced gold bullion from ore treated in a small amalgamation plant.

YUBA COUNTY

The value of the gold and silver produced from placer and lode operations in Yuba County in 1930 was $970,069, a decrease from $1,458,687 in 1929. The county has long been the center of important gold-dredging operations, but the output of gold from that method of mining has been declining gradually in recent years. In 1930 the output of the gold-dredging industry of Sacramento County again surpassed that of Yuba. Little attention has been given to gold quartz mining in Yuba County during the past 10 years; in 1930 gold ore was produced from prospects near Brownsville, Challenge, and Dobbins. The quartz prospects occur[47] in the amphibo.

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[46] State Mineralogist, Twenty-fourth Annual Report: 1928, p. 7.
[47] State Mineralogist, Twenty-sixth Annual Report; 1930, p. 188.

lite schists and in the vicinity of the contacts of basic igneous intrusives of granitic texture with the amphibolite schists and similar greenstones.

Camptonville district.—The Garden Valley dredge on Willow Creek about 4 miles south of Camptonville was operated by the Gold Dredges (Inc.) (Ltd.) until July 1 and by the present owner until October. The gravel deposit extends along Willow Creek nearly a mile and is composed largely of hydraulic mine tailings from the Depot Hill placers, but it is claimed [48] there is some gravel in the creek that has never been worked on account of water and lack of grade. Small lots of bullion purchased by merchants in the neighborhood were sent to the San Francisco Mint.

Challenge district.—The Mount de Oro mine was operated during 1930 and produced about 50 ounces of gold 0.812 fine. The ore shoot has been opened for a length of 90 feet on the 120-foot level, which connects by a raise 50 feet on the dip with the lowest adit and with a shaft.

Dobbins district.—Fifteen placers and one lode mine in the Dobbins district produced $10,651 in gold and 23 ounces of silver. The most important operations were at the property of the Red Cross Mining Co. The 2-stamp mill on the property is equipped for cyanidation; the ore is broken to 1½-inch size, reduced by stamps to 20-mesh, and agitated in a Devereaux agitator. The mine is opened by a shaft 130 feet deep and has 1,000 feet of tunnels with 500 feet of laterals; approximately 200 feet of new development work were done in 1930. The placer operations were carried on by many prospectors operating along Dry, Purdy, and Willow Creeks and using various contrivances for recovering gold, such as pans, rockers, and long-tom or dip boxes.

Mountain Hope district (*Brownsville*).—The Easy Money lode mine at Brownsville was under development, and a little gold bullion was recovered by amalgamation. At the Rose gravel mine near Rackerby some gold was recovered.

Smartsville district.—Many prospectors worked in the Smartsville district and along the Yuba River, particularly in the vicinity of Parks Bar Bridge, and produced $9,604 in gold and 45 ounces of silver, chiefly by the long-tom method. Most of the recovered gold had a fineness ranging from 0.909 to 0.928.

Strawberry Valley district.—Merchants reported purchases of many small lots of gold from prospectors working in the Strawberry Valley district within a radius of 10 miles of Strawberry. Most of the gold was recovered by ground sluicing. The total output amounted to $1,749 in gold and 8 ounces of silver.

Yuba River district (*Browns Valley, Hammonton, Marysville*).—The Yuba Consolidated Gold Fields has been the largest and most productive gold-dredging concern in California; in course of its operations it has had 19 dredges working ground in the Yuba River district. In 1930 three dredges were in operation the entire year and one from March to July, when dredge No. 14 worked out its available ground. According to the printed annual report of the company [49] the total area dredged was 141.2 acres, and the average value recovered per cubic yard was 6.71 cents with the cost of refining and express charges deducted. The cost of dredging was 4.30 cents and the net profit 2.41 cents per cubic yard. During the year ended February 28, 1931, the dredges handled 14,446,494 cubic yards of material at a total cost of $621,165.84, with net returns of $969,531.91 and a profit of $348,366.07, compared with 17,222,691 cubic yards handled the previous year at a cost of $742,882.37 with net returns of $1,235,560.75 and a profit of $492,678.38. The State mineralogist's report [50] states that the total yardage dredged from 1904 to February 28, 1929, was 426,289,205 cubic yards, which yielded a gross return of $58,254,035.95 and a net operating profit of $35,721,560.33. Additional details of yardage handled and costs of dredging by the Yuba Consolidated Gold Fields are given in the State report, from which the following figures are taken.

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[48] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 195.

[49] Yuba Consolidated Gold Fields Annual Report for year ended Feb. 28, 1931.

Output, operating costs, etc., Yuba Consolidated Gold Fields, 1916–1929 [1]

Year	Yardage	Average yield (cents)	Net total yield	Operating costs (cents per yard)	Profits
1915–16	17, 750, 000	12. 02	$2, 133, 528	4. 27	$1, 374, 868
1916–17	18, 490, 000	14. 86	2, 748, 197	3. 99	2, 009, 500
1917–18	15, 460, 000	18. 42	2, 849, 220	4. 90	2, 090, 691
1918–19	15, 996, 000	19. 49	3, 117, 791	7. 22	1, 962, 426
1919–20	23, 523, 000	13. 66	3, 213, 213	6. 99	1, 645, 548
1920–21	23, 148, 000	15. 16	3, 510, 170	7. 48	1, 779, 584
1921–22	26, 035, 000	14. 65	3, 814, 645	6. 94	2, 006, 879
1922–23	24, 039, 000	8. 50	2, 043, 305	4. 55	1, 056, 863
1923–24	23, 381, 276	11. 10	2, 596, 433	4. 50	1, 543, 128
1924–25	17, 490, 671	9. 43	1, 649, 010	5. 19	739, 928
1927–28	24, 543, 176	13. 19	3, 232, 794	4. 71	2, 077, 871
1928–29	24, 948, 295	8. 81	2, 196, 846	4. 53	1, 066, 124

[1] No figures given for 1925–26 and 1926–27 in State report.

Development of the Too Handy prospect began after gold-bearing quartz had been dug from the Yuba River bed by one of the dredges of the Hammon Engineering Co. This company proceeded to prospect for the owners by sinking a vertical shaft 410 feet. The shaft was sunk in unusually hard rock, and at 350 feet a level was driven about half a mile in a southeasterly direction. A winze from the 350 level was sunk 240 feet. The vein is of fair width, but assays show it spotted and irregular in gold content. The sulphides, principally pyrite, are said to carry most of the pay.[51] Work at this prospect was stopped August 4, 1930.

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[50] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 197.
[51] State Mineralogist, Twenty-sixth Annual Report: 1930, p. 192.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN OREGON[1]

(MINE REPORT)

By V. C. Heikes[2]

CONTENTS

	Page		Page
Summary	1029	Review by counties and districts—Contd.	
Mining industry	1033	Douglas County	1040
Ore classification	1033	Grant County	1041
Metallurgic industry	1035	Jackson County	1042
Review by counties and districts	1037	Josephine County	1043
Baker County	1037	Lane County	1045
Coos and Curry Counties	1039	Marion County	1045
Coos County	1040	Union County	1046
Curry County	1040	Wheeler County	1046

SUMMARY

The value of the mine production of gold, silver, copper, lead, and zinc in Oregon was 33 per cent less in 1930 than in 1929; the output of each metal except zinc decreased. For the first time in the history of Oregon zinc was produced; it was recovered from ore shipped to a custom lead-zinc selective flotation plant in Utah. The largest decreases in gold were in Jackson and Curry Counties; in silver, in Grant County; and in copper, in Josephine and Douglas Counties. The decrease in lead was in Grant County. The total value of the metal output of Oregon in 1930 was $325,143, which is much less than the yearly average ($548,800) for the decade 1921 to 1930.

Of the 8,994 tons of ore and old tailings treated, 4,038 tons were gold ore, 1,033 tons copper ore, 43 tons lead-zinc ore, and 3,880 tons old tailings. The lead recovered in 1930 came from gold ore mined in Grant County and lead-zinc ore mined in Marion County.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed December, 1931.

[2] Helen M. Gaylord, of the Bureau of Mines, prepared the statistics for this report.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1921–1930, in terms of recovered metals

Year	Mines producing		Ore and old tailings (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1921	23	84	40,333	42,668.39	$882,034	42,120	$42,120
1922	44	126	27,522	25,714.60	531,568	151,812	151,812
1923	55	151	50,385	24,091.14	498,008	96,322	78,984
1924	43	71	44,842	26,695.36	551,842	38,103	25,529
1925	53	94	27,483	18,982.80	392,409	32,793	22,758
1926	49	100	21,727	13,243.10	273,759	29,733	18,553
1927	36	150	26,839	14,676.16	303,383	45,830	25,986
1928	41	90	12,676	10,931.19	225,968	30,924	18,091
1929	45	111	10,509	17,092.00	353,323	30,009	15,995
1930	47	143	8,994	14,401.34	297,702	9,000	3,465

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	174,300	$22,485					$946,639
1922	1,046,525	141,281	76,970	$4,233			828,894
1923	1,283,476	188,671	27,523	1,927			767,590
1924	768,395	100,660	513	41			678,072
1925	106,325	15,098	5,612	488			430,753
1926	296,454	41,504	11,549	924			334,740
1927	488,200	63,954	5,300	334			393,657
1928	358,463	51,619	13,246	768			296,446
1929	655,746	115,411	20,180	1,271			486,000
1930	176,300	22,919	9,113	456	12,528	$601	325,143

GOLD

The mine production of gold in Oregon in 1930 was $297,702, or $55,621 less than in 1929. Lode mines yielded 28 per cent and placers 72 per cent of the total gold produced, compared with 30 and 70 per cent, respectively, in 1929 and 47 and 53 per cent, respectively, in 1928. The output of gold from placers decreased 13 per cent and that from lode mines 22 per cent compared with 1929. The leading gold-producing counties in Oregon in 1930 were Jackson, Grant, Josephine, and Baker, named in order of output; these four counties produced 97 per cent of the total gold yield of the State. Douglas and Curry Counties each produced approximately $3,000; and Coos, Lane, Union, and Wheeler Counties produced less than $1,000 each.

Dry gold ore, of which 2,969 tons were treated in amalgamation mills, 971 tons were treated in concentrating mills, and 98 tons were sent direct to smelters, averaged in recovered metals $19.75 in gold and 1.49 ounces of silver to the ton and a little lead and copper. Only a small amount of gold ($1,235) was recovered from the 3,880 tons of old tailings cyanided and from old mill cleanings.

SILVER

The mine production of silver in Oregon in 1930 was 9,000 ounces, valued at $3,465, a decrease of 21,009 ounces and $12,530 from 1929. The output of silver was largely from gold and copper ores and placer bullion, with a small amount from lead-zinc ore, old tailings cyanided, and old mill cleanings; no ore was treated for silver alone. Lode mines produced 20,810 ounces less silver than in 1929 and placers 199 ounces less. Most of the lode silver in 1930 came from gold concentrates from ore mined in Grant County. Copper ore sent direct to a smelter yielded 1,050 ounces of silver, and gold ore sent to a smelter 1,006 ounces. The yield of silver from placer mining was 1,579 ounces.

COPPER

The mine production of copper in Oregon in 1930 was 176,300 pounds, valued at $22,919, a decrease of 479,446 pounds (73 per cent) and $92,492 (80 per cent) from 1929. All the copper ore mined was of smelting grade; it came from Josephine and Douglas Counties. The total amounted to 1,033 tons and averaged in recovered metals $2.24 in gold and 1.02 ounces of silver to the ton and 8.49 per cent of copper.

LEAD

The mine production of lead in Oregon in 1930 was 9,113 pounds, a decrease of 55 per cent from 1929. The lead produced was largely from ore concentrated by flotation. A nominal output of lead (392 pounds) was recovered from gold ore shipped to a smelter.

ZINC

Lead-zinc ore mined in Marion County was shipped to a custom flotation plant in Utah, and lead concentrate and zinc concentrate were produced. The zinc recovered was the first credited output of the metal in Oregon.

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1930, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Baker	10	12	986.95	$20,402	859	$331
Coos		5	18.28	378	2	1
Curry	1	9	132.45	2,738	16	6
Douglas	4	5	151.27	3,127	1,084	417
Grant	4	8	5,071.74	104,842	5,520	2,125
Jackson	11	34	5,361.11	110,824	919	354
Josephine	12	70	2,609.97	53,953	472	182
Lane	2		19.60	405	8	3
Marion	1				102	39
Union	1		37.69	779	14	5
Wheeler	1		12.28	254	4	2
	47	143	14,401.34	297,702	9,000	3,465
Total, 1929	45	111	17,092.00	353,323	30,009	15,995

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1930, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Baker							$20, 733
Coos							379
Curry							2, 744
Douglas	26, 153	$3, 400					6, 944
Grant	502	65	6, 053	$303			107, 335
Jackson							111, 178
Josephine	149, 274	19, 406					73, 541
Lane							408
Marion	371	48	3, 060	153	12, 528	$601	841
Union							784
Wheeler							256
	176, 300	22, 919	9, 113	456	12, 528	601	325, 143
Total, 1929	655, 746	115, 411	20, 180	1, 271			486, 000

The following table summarizes the metal output of Oregon by districts. The Eastern district covers Baker, Grant, Union, and Wheeler Counties; and the Western district covers Coos, Curry, Douglas, Jackson, Josephine, Lane, and Marion Counties.

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1930, by districts, in terms of recovered metals

District	Ore and old tailings short tons	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
Eastern:					
Lode	6, 448	1, 287. 41	$26, 613	5, 634	$2, 169
Placer		4, 821. 25	99, 664	763	294
	6, 448	6, 108. 66	126, 277	6, 397	2, 463
Western:					
Lode	2, 546	2, 741. 39	56, 670	1, 787	688
Placer		5, 551. 29	114, 755	816	314
	2, 546	8, 292. 68	171, 425	2, 603	1, 002
	8, 994	14, 401. 34	297, 702	9, 000	3, 465
Total, 1929	10, 509	17, 092. 00	353, 323	30, 009	15, 995

District	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Eastern:							
Lode	502	$65	6, 053	$303			$29, 150
Placer							99, 958
	502	65	6, 053	303			129, 108
Western:							
Lode	175, 798	22, 854	3, 060	153	12, 528	$601	80, 966
Placer							115, 069
	175, 798	22, 854	3, 060	153	12, 528	601	196, 035
	176, 300	22, 919	9, 113	456	12, 528	601	325, 143
Total, 1929	655, 746	115, 411	20, 180	1, 271			486, 000

MINING INDUSTRY

Because of the adverse conditions under which mining was carried on in 1930, some of the larger properties remained closed and very few new enterprises were started. Placer miners were hampered by shortage of water, and from all parts of the State short water seasons were reported. The territory in Jackson and Josephine Counties, drained by the Rogue River and its tributaries, yielded a large part of the total gold output of the State, as this section affords an attractive opportunity for the prospector and small gold producer.

The world production of gold was summarized in a recent economic report [3] of the United States Bureau of Mines. The Bureau of Mines also collaborated with the United States Geological Survey in a detailed summary [4] relating to the gold resources and reserves in the United States. Gold was one of the main topics for discussion at the International Geologic Congress at Pretoria, South Africa, in 1929. As to the possible gold resources of Oregon, D. F. Hewett [5] makes the following statements and gives bibliographical references:

> Only two regions in Oregon deserve consideration in a report on gold output—the most productive in Baker and Grant Counties, in eastern Oregon, and the other in Jackson and Josephine Counties, in southwestern Oregon. There have been two peaks in production of both placers and lodes; the latest has been followed by a great decline. The peaks in placer production occurred in 1901 and 1916, the latter being due to the dredges in Sumpter Valley. The peaks in lode production fell in 1902 and 1915.
>
> *Reserves.*—The coincidence of the latest decline with decrease in purchasing power of gold, taken in connection with the nature of the deposits, indicates a continued decline in production, which may be expected to be more rapid for the placers than for the lode mines. The maximum estimate might be reached if the purchasing power of gold returned to the 1913 standard.
>
> The estimated minimum production for 1928 to 1950 is 100,000 ounces each from lode mines and placer mines, and the maximum total is 750,000 ounces (600,000 ounces from lodes and 150,000 ounces from placers).
>
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ORE CLASSIFICATION

Ore and old tailings sold or treated in Oregon, 1921–1930, with content in terms of recovered metals

DRY GOLD ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1921	37, 935	19, 075. 66	36, 490			
1922	6, 449	6, 189. 97	15, 250	10, 749	1, 276	
1923	29, 472	7, 506. 11	25, 515	3, 301	857	
1924	29, 855	8, 941. 37	18, 352	1, 143	513	
1925	24, 561	9, 554. 34	20, 369	205	4, 016	
1926	16, 094	6, 742. 07	22, 146	3, 043	11, 549	
1927	10, 625	4, 977. 88	36, 376	1, 720	5, 300	
1928	7, 084	4, 822. 74	20, 134	1, 103	9, 552	
1929	6, 673	4, 909. 98	21, 341	2, 521	20, 180	
1930	7, 918	3, 916. 80	6, 269	502	6, 053	

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[3] Ridgway, R. H., Summarized Data of Gold Production: Econ. Paper 6, Bureau of Mines, 1929, 63 pp.

[4] Gold Reserves of United States: Reprint from The Gold Resources of the World, 15th Internat. Geol. Cong., So. Africa, 1929.

[5] See footnote 4.

Ore and old tailings sold or treated in Oregon, 1921–1930, with content in terms of recovered metals—Continued

DRY SILVER ORE [1]

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1922	3, 955	[illegible]. 76	119, 146	23, 587	75, 674	
1923	1, 973	14. 30	46, 234	18, 221	26, 666	
1924	176	2. 10	4, 778	2, 513		
1925	182	16. 02	9, 352	520	1, 556	
1926	1	. 29	262			
1928	1,000	11. 01	1, 908			

COPPER ORE

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1921	2, 398	434. 02	1, 339	174, 300		
1922	17, 117	2, 771. 51	14, 405	1, 012, 189		
1923	18, 940	3, 181. 98	22, 511	1, 261, 954		
1924	14, 831	2, 001. 75	12, 694	764, 709		
1925	2, 740	375. 06	1, 941	105, 600		
1926	5, 632	562. 32	6, 482	293, 411		
1927	16, 214	811. 92	8, 299	486, 480		
1928	4, 577	248. 95	4, 104	357, 041		
1929	3, 836	234. 89	6, 890	653, 225		
1930	1, 033	112. 00	1, 050	175, 427		

LEAD-ZINC ORE [2]

Year	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
1930	43		102	371	3, 060	12, 528

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[1] No production reported for 1921, 1927, 1929, and 1930.
[2] No production reported for 1921–1929.

Ore and old tailings sold or treated in Oregon in 1930, with content in terms of recovered metals

Source	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore and old tailings	7, 918	[1] 3, 916. 80	[1] 6, 269	502	6, 053	
Copper ore	1, 033	112. 00	1, 050	175, 427		
Lead-zinc ore	43		102	371	3, 060	12, 528
Total, lode mines	8, 994	4, 028. 80	7, 421	176, 300	9, 113	12, 528
Total, placers		10, 372. 54	1, 579			
	8, 994	14, 401. 34	9, 000	176, 300	9, 113	12, 528
Total, 1929	10, 509	17, 092. 00	30, 009	655, 746	20, 180	

[1] Includes 28.79 ounces of gold and 33 ounces of silver from old mill cleanings.

Value of metals from ore and old tailings sold or treated in Oregon in 1930, by classes of ore

Class	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc	Total value
	Short tons						
Dry gold ore and old tailings	7, 918	[1] $80, 968	[1] $2, 414	$65	$303		$83, 750
Copper ore	1, 033	2, 315	404	22, 806			25, 525
Lead-zinc ore	43		39	48	153	$601	841
	8, 994	83, 283	2, 857	22, 919	456	601	110, 116
Total, 1929	10, 509	106, 354	15, 047	115, 411	1, 271		238, 083

[1] Includes value of 28.79 ounces of gold and 33 ounces of silver from old mill cleanings.

The following table summarizes the ore output of Oregon by districts. The Eastern district covers Baker, Grant, Union, and Wheeler Counties; and the Western district covers Coos, Curry, Douglas, Jackson, Josephine, Lane, and Marion Counties.

Ore and old tailings sold or treated in Oregon in 1930, by districts, with content in terms of recovered metals

District	Ore and old tailings	Gold	Silver	Copper	Lead	Zinc
DRY GOLD ORE						
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Eastern	6,448	[1] 1,287.41	[1] 5,634	502	6,053	----------
Western	1,470	[2] 2,629.39	[2] 635	----------	----------	----------
	7,918	3,916.80	6,269	502	6,053	----------
Total, 1929	6,673	4,909.98	21,341	2,521	20,180	----------
COPPER ORE						
Western	1,033	112.00	1,050	175,427	----------	----------
	1,033	112.00	1,050	175,427	----------	----------
Total, 1929	3,836	234.89	6,890	653,225	----------	----------
LEAD-ZINC ORE [3]						
Western	43	----------	102	371	3,060	12,528
	43	----------	102	371	3,060	12,528

[1] Includes 9.90 ounces of gold and 21 ounces of silver from old mill cleanings.
[2] Includes 18.89 ounces of gold and 12 ounces of silver from old mill cleanings.
[3] No production reported for 1929.

METALLURGIC INDUSTRY

Ore mined in Oregon in 1930 amounted to 5,114 short tons, of which 2,969 tons were treated at gold and silver mills, 1,014 tons were treated at concentrating mills, and 1,131 tons were sent direct to smelters. The only material treated by cyanidation in 1930 was 3,880 tons of old tailings. Bullion recovered at 23 plants equipped for treating ore by amalgamation, not including 9 hand mortars or arrastres, yielded $55,110 in gold and 510 ounces of silver.

The ore treated at gold and silver mills by amalgamation averaged in recovered metals $20.86 in gold and 0.20 ounce of silver to the ton.

Ore treated by flotation in two concentrating mills, one in the State and one in Utah, yielded 135 tons of concentrates averaging in recovered metals $81.36 in gold and 33.59 ounces of silver to the ton, 3.23 per cent of lead, 4.64 per cent of zinc, and a little copper. The 1,033 tons of copper ore shipped direct to smelters averaged in recovered metals $2.24 in gold and 1.02 ounces of silver to the ton and 8.49 per cent of copper.

Mine production of metals in Oregon in 1930, by methods of recovery

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	2,969	[1] 3,008.18	[1] 609			
Old tailings cyanided	3,880	30.95	203			
Ore smelted	1,131	[2] 424.26	[2] 2,064	175,427	392	
Concentrates smelted: Flotation	146	565.41	4,545	873	8,721	12,528
Total, lode mines		4,028.80	7,421	176,300	9,113	12,528
Total, placers		10,372.54	1,579			
		14,401.34	9,000	176,300	9,113	12,528
Total, 1929		17,092.00	30,009	655,746	20,180	

[1] Includes 12.71 ounces of gold and 25 ounces of silver from old mill cleanings.
[2] Includes 16.08 ounces of gold and 8 ounces of silver from old mill cleanings.

Mine production of metals from gold and silver mills in Oregon in 1930, by districts

District	Ore and old tailings treated		Recovered in bullion				Concentrates and recovered metal		
			Amalgamation		Cyanidation				
	Ore	Old tailings	Gold	Silver	Gold	Silver	Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Eastern	1,570	3,880	[1] 528.61	[1] 202	30.95	203			
Western	1,399		[2] 2,479.57	[2] 407			11	34.04	10
	2,969	3,880	3,008.18	609	30.95	203	11	34.04	10
Total, 1929	2,514	100	2,619.68	970	13.74	36	1	6.70	6

[1] Includes 8.57 ounces of gold and 20 ounces of silver from old mill cleanings.
[2] Includes 4.14 ounces of gold and 5 ounces of silver from old mill cleanings.

Mine production of metals from concentrating mills in Oregon in 1930, by districts

District	Ore to concentrating mills	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Eastern	971	118	531.37	4,433	502	5,661	
Western	43	17		102	371	3,060	12,528
	1,014	135	531.37	4,535	873	8,721	12,528
Total, 1929	4,035	291	1,597.00	20,081	2,521	20,180	

Mine production of metals from Oregon concentrates in 1930, in terms of recovered metals

BY DISTRICTS

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Eastern	118	531.37	4,433	502	5,661	----------
Western	28	34.04	112	371	3,060	12,528
	146	565.41	4,545	873	8,721	12,528
Total, 1929	292	1,603.70	20,087	2,521	20,180	----------

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	129	565.41	4,443	502	5,661	----------
Lead	3	----------	93	371	3,060	----------
Zinc	14	----------	9	----------	----------	12,528
	146	565.41	4,545	873	8,721	12,528

Mine production of metals from Oregon crude ore shipped to smelters in 1930, in terms of recovered metals

BY DISTRICTS

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Eastern	27	195.15	795	----------	392
Western	1,104	213.03	1,261	175,427	----------
	1,131	408.18	2,056	175,427	392
Total, 1929	3,860	907.75	7,138	653,225	----------

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry gold	98	296.18	1,006	----------	392
Copper	1,033	112.00	1,050	175,427	----------
	1,131	408.18	2,056	175,427	392

REVIEW BY COUNTIES AND DISTRICTS

BAKER COUNTY

Baker and Eagle Creek (*Sparta*) *districts.*—Two lode mines and miscellaneous lode-mine operators in the Baker and Sparta districts sold bullion amounting to 314.41 ounces of gold and 70 ounces of silver, valued together at $6,526. The Gold Center claim east of Baker produced from pocket mining some specimen ore, which was treated in a hand mortar and yielded gold 0.942 fine. In the Sparta district the Macy or Maiden Gulch mine produced from a vein in granite more than 100 tons of ore yielding gold 0.744 to 0.856 fine by amalgamation; this ore was treated in a Colorado Iron Works ball mill. The mine is developed by a 550-foot tunnel. The Oregon Copper Co. did a little development work with a much-reduced force. In the Eagle Creek district a 3-stamp mill was operated a few days on stocked ore from the United Consolidated group near Paddy

Creek and recovered a little bullion and 337 pounds of concentrates, containing gold, which were shipped to a smelter.

Bull Run district (*Unity*).—The Record Gold Mining Co. did some assessment work on its property in the vicinity of Unity. A test run of ore from the Whited property was made in the new concentration-flotation mill erected in 1930.

Cable Cove district.—The Morning Star lode claim in the Cable Cove district produced 4 tons of sulphide ore containing gold and silver; the ore was shipped to the smelter at Midvale, Utah. The mine is developed by three tunnels (the longest 190 feet), a 50-foot shaft, and 300 feet of drifts.

Cornucopia district.—At the Union-Companion and Last Chance properties of the Cornucopia Mines Co. a lessee treated old mill tailings in a cyanidation plant and shipped gold and silver bullion, as well as sorted ore and old mill cleanings, to the smelter. Some gold 0.839 fine was produced from Pine Creek placers in the Cornucopia district.

Greenhorn district.—The Consolidated Oregon Gold Mines Co. operated the Banner-Snow Creek group of mines in the Greenhorn district and treated about 800 tons of ore in a 30-ton ball mill equipped for amalgamation and gravity concentration; later the mill was equipped for flotation with three machines or cells of the Southwest-Engineering Co. type, but the concentrates produced were not sold. Gold ore from the Columbia claim yielded bullion by amalgamation.

Mormon Basin district (*Rye Valley, Malheur*).—The Mormon Basin district is on the divide between Baker and Malheur Counties; its output in 1930, however, came largely from Baker County and has been credited to that county in the foregoing tables. Eight placer producers reported $6,395 in gold and 43 ounces of silver from gravel worked by dredge, hydraulic, drift, and ground sluicing equipment. The property of the Superior Leasing Co. was in the hands of a trustee, who operated the dredge during litigation proceedings and produced gold 0.842 to 0.858 fine; the dredge is near Bridgeport on Clarks Creek, a tributary of Burnt River. Merchants sent to the mint bullion obtained from old dredge cleanings and placer dust purchased from prospectors. According to a press release[6] "some work was going forward on the Sunday Hill, Randall, Hice, Blue Mud, Summit, and Overshot prospects. All these prospects are developing gold quartz veins in schist, which is cut by granodiorite and diorite intrusions."

Sumpter district.—The Hydraulic Dredging & Construction Co., working on the Powder River 1½ miles below Sumpter, recovered gold 0.657 fine from 4,000 cubic yards of material handled with a power shovel, sluice, and small suction dredge of 40 yards daily capacity. The operation of its dredge was not particularly successful on account of low water. The company controls 80 acres of land. Ground sluicing and hydraulic operations on the Powder River yielded gold 0.900 fine, which was sold to merchants.

Virtue district.—The White Swan mine in the Virtue district was under development. No production was reported.

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[6] U. S. Geological Survey press release, Progress Made in Mineral Survey of Oregon: Mar. 2, 1931, 18 pp.

Weatherby district (*Chicken Creek*).—The Gleeson and Little Bonanza claims about 4 miles northeast of Weatherby were operated a short time and produced 23 tons of ore, which was treated in a 5-stamp amalgamation mill. The gold, 0.749 fine, was shipped to the Boise assay office. The mill was equipped late in 1930 with an Isbell vanner for recovering the sulphide minerals, chiefly tetrahedrite, from the ore. Considerable development work, consisting of a crosscut, tunnel, drifts, shallow shafts, and some stoping, was done on the Gleeson property. The Emigrant placer on Chicken Creek yielded some gold 0.800 fine by sluicing.

COOS AND CURRY COUNTIES

The value of the production of gold in Coos and Curry Counties was $3,116 in 1930, compared with $38,525 in 1929. The value is for the gold only and does not include the platinum metals, for which incomplete reports were received from producers. The black sands not only on the present beach but also on the borders of the coastal plain, sometimes 4 miles from the ocean and at altitudes up to 200 feet, have been worked for their gold content. Diller[7] in his investigations showed that the gray sands averaged 7.2 cents a ton, whereas the average of the black sands examined was 54 cents. The gold is native and occurs in excessively thin cup-shaped scales, of which 600 colors are required to make 1 cent. The matter of saving such gold is a vexing one, and much experimenting has been done; however, the method using old Chinese tables covered with matting or burlap is the method so far most successful. The following paragraph is quoted from the United States Geological Survey press release cited on page 1038.

> Despite past failures, attempts are made from time to time to work the deposits of black sand along the Oregon coast, and an examination of available information brings out the fact that little is known as to the extent of these deposits. Many samples have been tested and found to contain various amounts of magnetite, chromite, ilmenite, and other valuable minerals, including gold and platinum, but data on which to base trustworthy quantitative estimates are very scanty. The deposits along the present and ancient beaches are known in a general way to be distributed along stretches that aggregate 40 miles or more in length. A detailed survey of these stretches might be expected to shed light on the extent of the deposits and aid engineers in making more exact estimates of their value preliminary to attempts at exploitation.

Reports by Diller[8] and Winchell[9] based on field work done mostly before 1914, describe many of the mines and prospects that have been developed on the gold-bearing lodes. A few additional mines are described by Butler and Mitchell,[10] who examined Curry County in 1915.

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[7] Diller, J. S., A Geological Reconnaissance in Northwestern Oregon: U. S. Geol. Survey, 17th Ann. Rept., 1896, pt. 1, p. 517.

[8] Diller, J. S., Mineral Resources of Southwestern Oregon: U. S. Geol. Survey Bull. 546, 1914, 147 pp.

[9] Winchell, A. N., Petrology and Mineral Resources of Jackson and Josephine Counties, Oreg.: Mineral Resources of Oregon, vol. 1, No. 5, Oregon Bur. Mines and Geology, 1914, 264 pp.

[10] Butler, G. M., and Mitchell, J. M., Preliminary Survey of the Geology and Mineral Resources of Curry County, Oreg.: Mineral Resources of Oregon, vol. 2, No. 2, Oregon Bur Mines and Geology, 1916, 132 pp.

COOS COUNTY

Some gold and platinum metals were produced from beach sands in the vicinity of Myrtle Point in the Coos Bay district. The Lane Extension and Pioneer property in the Randolph district 6 miles northeast of Bullards produced about 10 ounces of gold, 5 ounces of platinum, and 1 ounce of iridium during development work. Some gold was taken from the Eagle claim. Prospecting shafts have been sunk on the third beach 160 feet above sea level.

CURRY COUNTY

The White Elephant sands on Boulder Creek in the Agness district produced a little gold 0.904 fine by sluicing. In the Gold Beach district the Agate Beach claim on the present beach 4 miles due north of Rogue River was worked with a long tom, and gold 0.901 fine and a little platinum and osmiridium were recovered from about 200 cubic yards of material treated between August and December. In the Port Orford and Sixes districts at Cape Blanco beach sands on the present beach 1½ miles southeast of Cape Blanco Light were worked between March and December, and a successful recovery was made with the old-fashioned Chinese tables. The gold that was sold was 0.860 to 0.880 fine, with some platinum and osmiridium. Various methods were used in the Sixes district in the treatment of beach sands, resulting in the saving of 28.75 ounces of gold averaging about 0.882 fine. A No. 2 giant was used to hydraulic the Madden beach sands, where equipment was installed to recover the metals by the Luckenback process. A tarlike substance is employed on a table of the Frue vanner type, which takes up the metals and rejects the gangue. The Golden Dream and Golden Rattler claims on the West Fork of Mule Creek in the Mule Creek district were under development, and a small amalgamation mill of about 5 tons capacity was erected in December.

Checto or China Digings district.—Several lodes and placers in the Checto district were under development. The Robert E. mine near the head of Babyfoot Creek, which became an important producer of gold in 1928, was again a producer in 1930. The district was included in a survey by the United States Geological Survey; the press release cited on page 1038 describes the quartz vein of the Robert E. mine as "a rather persistent fracture in greenstone. Toward one end the vein passes into serpentine and dies out. The outcrop shows the usual iron oxides and carries a moderate amount of gold. Underground development work, however, found a very rich 'blind' ore shoot containing pyrite, arsenopyrite, and free gold." The gold produced in 1930 averaged 0.864 fine.

DOUGLAS COUNTY

Crackerjack district.—Hydraulic mining of gravels in Tennessee Gulch and Cow Creek yielded 22.27 ounces of gold, chiefly from the Douglas placer near Azalea. The water supply was rather scarce.

Nugget (South Myrtle Creek) district.—The Chieftain mine on South Myrtle Creek in the Nugget district was under development by the Chieftain Mines (Inc.) almost continuously during 1930.

High-grade pyritic ore was shipped to a smelter, and lower-grade material was stored on the dump awaiting the construction of a concentrator. The Continental mine produced a little pyritic ore containing gold. Mine workings extend for several hundred feet along the strike of the lode and to depths of 175 feet at the Chieftain and 185 feet at the Continental. For the most part the lodes range from 1 to 4 or 5 feet in width and consist chiefly of quartz. Below a shallow oxidized zone they contain sulphides, chiefly pyrite with very little chalcopyrite. In the sulphide ore from the Chieftain mine no free gold has been found.

Olalla district.—Placer gold was produced from Coarsegold Gulch and Olalla Creek by small sluicing and panning operations by prospectors who sold their gold, 0.685 fine, to merchants.

Riddles district.—The Silver Peak Copper Co. shipped to a smelter from its mine near Riddles 264 tons of copper sulphide ore containing 23,856 pounds of copper, 782 ounces of silver, and 15 ounces of gold; most of this ore was mined in 1929. The ore contained some zinc also. The mine is developed by a tunnel 550 feet long and by 800 feet of drifts. The Umpqua Consolidated shipped one car of copper sulphide ore. The press release cited on page 1038 says "the Silver Peak and Umpqua Consolidated mines are on different parts of the same lode. This very interesting deposit occurs in a mineralized zone 70 feet or more wide formed in a layer of schistose rock that is associated with greenstone and has been intruded by dikes of porphyry. * * * In places the lode contains shoots of solid sulphides 10 feet or more wide composed of pyrite, chalcopyrite, and bornite."

GRANT COUNTY

Canyon district.—The principal placer in the Canyon district is that worked by the Empire Gold Dredging & Mining Co. on the John Day River and Dixie Creek. A total of about 685,000 cubic yards of material was handled with a 2,500-cubic yard electrically operated dredge equipped with 76 buckets, each of 5-cubic foot capacity. The company is not the owner of mining claims but pays a royalty to the owners of the lands on which it operates. The gravel yielded 3,319.96 ounces of gold 0.867 fine. Merchants and banks in the region purchased many small lots of placer gold from prospectors.

Granite district.—A steam-operated dredge of 1,500-cubic foot capacity, on Granite Creek, produced 966 ounces of gold 0.750 to 0.800 fine. A total of approximately 200,000 cubic yards of gravel was handled by the dredge, which operated intermittently. The placers extend 5 miles along Granite Creek. Some gold was also produced from the Gold Bug placers on Rabbit Creek. The Buffalo Gold Mining Co. operated the Buffalo lode mine and its 40-ton flotation plant until June and treated about 970 tons of ore yielding 118 tons of gold concentrates containing silver and lead; 10 tons of crude ore were shipped direct to the smelter. The plant was built in 1924; 16 pneumatic cells and other flotation equipment were recently added. The development work for 1930 consisted of drifting 50 feet on the vein.

Quartzburg district.—Development work was done on the Sherbandy group, where a dozen men were employed in driving a crosscut beneath some mineralized croppings; no production was reported.

Susanville district.—The Bear Creek drift placer on Bear Creek near Galena produced 15 ounces of gold 0.874 fine from 200 cubic yards of material handled during the winter months.

JACKSON COUNTY

Ashland district.—The principal mines of the Ashland district are on Ashland and Wagner Creeks, which are included in the Bear Creek Basin. The Ashland mine has been inactive for a long time as a result of litigation. Developed to a depth of 900 feet by a former owner, it was reopened early in 1929. Surface improvements include the construction of a 10-stamp amalgamation and concentration mill, for which the equipment has been delivered. The Shorty Hope group of six claims in the same district has more than 2,000 feet of development and is under the same ownership as the Ashland.

Gold Hill district.—Six lode mines and eight placers in the Gold Hill district reported 243 tons of ore, 5,044.34 ounces of gold, and 862 ounces of silver, valued together at $104,608. The Sylvanite, operated by the Discon Gold Mining Co., was the most important producer of gold from ore treated in a 10-stamp amalgamation-gravity concentration mill. The bullion was shipped, but the concentrates (averaging about $40 a ton in gold) were held in storage. During the time of operation a small high-grade ore shoot, opened at a depth of 800 feet, is said to have more than paid expenses. At the Carbonate lode on Evans Creek the mine and mill were operated a short time, and 6 tons of ore yielded a little gold 0.738 fine. On Foots Creek the North Pole mine of the Robinson Mining Co. produced ore that was tested in a 5-stamp amalgamation-gravity concentration custom plant, and gold 0.752 to 0.816 fine was recovered; the sulphides were not saved. The Rogue River Gold Co. owns an electrically equipped dredge on Foots Creek; the dredge is equipped to handle 5,000 cubic yards of material per 24-hour day. Gold was also produced from the Black Channel, Boling, Lance, Matthews, and Pre Fountain properties.

Jacksonville district.—Four placers and two lode mines produced a little ore and 110 ounces of gold in the vicinity of Jacksonville. The Big Six, Davies, Miller, and miscellaneous small producers from ground-sluicing operations contributed to the gold output. Cleanings from the Old Norling mill yielded some gold bullion, and some gold was produced from pocket mining and sold to merchants. The Opp mine was idle.

Squaw Creek district.—Shallow workings on the Great Eastern claim in the Squaw Creek district were reported (see press release cited on page 1038) to show enough chalcopyrite distributed through a width of 15 feet to classify the mass as low-grade ore. The extensive workings of the Blue Ledge mine in the Elliott Creek district in California 4 miles south of the Oregon boundary disclose lenticular bodies of chalcopyrite ore distributed along zones in a schist formation similar to that in the Squaw Creek area. From January to June ore from the Blue Ledge mine was hauled 39 miles over an improved road, following the Big Applegate River, to the railroad at Medford, Oreg., and daily shipments were made to Tacoma, Wash.

Upper Applegate district.—Three lode mines and five placer producers in the Upper Applegate district reported 27 tons of ore, 206.77 ounces of gold, and 33 ounces of silver, valued together at $4,287. The Pacific placer in Ferris Gulch 3 miles northwest of Applegate was a producer of gold 0.813 to 0.817 fine. A total of about 3,000 cubic yards of material was handled by hydraulic mining. The operations were intermittent, the season lasting only 150 days between December and April. The operating company controls about 1,200 acres of ground and owns 45 miles of ditches. The Sineda Mining Co., operating the old Federal property on the Little Applegate River 12 miles south of Jacksonville, sold some gold produced from an old flume at the Federal mine to the San Francisco Mint. The company owns 7 miles of ditches and controls 160 acres of placer ground. Development only was done in 1930. At the Sterling placer development work consisted of constructing ditches and refitting the property. A little gold 0.854 fine was produced. The Roosevelt mine, belonging to the El Senora group, produced a little gold 0.829 fine. A small mill in Quartz Gulch is equipped with rolls and amalgamation plates. A 12-foot arrastre was used to reduce the ore. Some specimen gold was produced from the Wounded Buck claim. Preparations were under way to work the Lone Star placer in Star Gulch; one giant operated under a 150-foot head of water, clearing away débris. No gold was cleaned up.

JOSEPHINE COUNTY

Galice district.—Miscellaneous placers and four lode mines in the Galice district produced 560 tons of ore, 1,214.07 ounces of gold, and 114 ounces of silver, valued together at $25,141. Most of the placer output was from the Antlers, Dean, and Sun Flower claims. Placers on Briggs Creek, including the McClung property, produced gold 0.933 fine. The Snow Flower Mining Co., which heretofore produced gold from its quartz mine, discovered its placers to be of value in May. The placers were under development until the end of the year and produced about 33 ounces of gold 0.874 fine. Other producers were the Fowler and the Norton placers. The Robertson or Bunker Hill mine was the principal producer of ore milled in an amalgamation-gravity concentration plant equipped with 10 stamps, a Deister, and an Overstrom table. A Pennsylvania syndicate in October took over the property, which earlier in the year had yielded about 1,000 ounces of gold. The following paragraph is quoted from the press release cited on page 1038.

> The rocks of this area are chiefly greenstones and gabbro, which have been intruded principally by granite. The workings of the Robertson mines partly explore a group of small veins that were formed along northwestward-trending fractures in greenstone near a tongue of the granite. The veins are composed chiefly of quartz. Near the surface iron oxides are abundant. The gold produced to date has come from an ore shoot in one of the veins. This shoot has been explored to a depth of about 300 feet. It is a tabular body, ranging from a few inches to a few feet in thickness and extending as much as 120 feet along the strike. It rakes or pitches steeply toward the south and continues downward beyond the limit (260 feet) of the present workings. Below the shallow oxide zone this body is composed of quartz with more or less pyrite and arsenopyrite. Free gold is present in both the oxide and sulphide zones

and locally is abundant enough to form bunches of very rich ore. Outside of the rich spots the ore generally runs from $25 to $35 a ton of which $10 is recovered by plate amalgamation, and most of the remainder is saved in a sulphide concentrate.

Grants Pass district.—Numerous small placers and one lode mine produced 225 tons of ore, 217.61 ounces of gold, and 43 ounces of silver, valued together at $4,515. The Black Jack, Wild Rose, and Buckskin group of the Edwards Mining Co. was prospected by drills, and about 300 feet of drifting were done. Some tests were made by flotation, and a total of 11 tons of concentrates containing principally gold and some silver was shipped. Placer gold was produced from Jump-off Joe and Green Creeks and from small sluicing operations along the Rogue River.

Greenback district.—The Greenback district occupies the northeast corner of Josephine County and includes the area east of the Southern Pacific Railroad, which is drained by Grave, Coyote, and Wolf Creeks. In the past parts of this district have been known as Wolf Creek, Grave Creek, Coyote Creek, and Leland districts. Miscellaneous placer operations and 140 tons of ore from lode mines yielded 428.20 ounces of gold and 59 ounces of silver, valued together at $8,875. The Spotted Fawn group produced gold ore treated in a 5-ton Chile mill, grinding the ore to 80 mesh and recovering the gold by amalgamation; the property is opened by 200 feet of drifts. At the Sugar Loaf mine on Reuben Creek development work resulted in the production of 100 tons of ore, treated in a Rib Cone ball mill of 12 tons capacity; the ore yielded 41 ounces of gold 0.856 fine by amalgamation. Bullion Mountain (Inc.) worked a placer on East Creek, a tributary of Grave Creek, and produced 241 ounces of gold 0.835 fine. A total of about 5,000 cubic yards of material was handled with two giants operating under a 500-foot head between March and April. The company controls 1,000 acres of land, and water is carried in 20 miles of ditch. Miscellaneous producers sold to Wolf Creek merchants gold recovered principally from gravels by hydraulic mining on Grave Creek and in the vicinity. With one giant operating at the Ruble or Forsyth placer on Coyote Creek considerable material was hydraulicked and some gold produced. This property extends about 6 miles along the bed of Coyote Creek and comprises about 300 acres. At one time the placer was operated with three giants, 6,000 feet of pipe, 8 miles of ditch, and two Ruble grizzly elevators 10 by 40 feet long and 6 feet high. The Ruble elevator is said to have been invented and first used at this property by its owner, S. Ruble.

Illinois River district.—The whole drainage area of the Illinois River and its tributaries, Josephine Creek, Sucker Creek, and the West Fork in the vicinity of Kerby, Selma, Waldo, Takilma, and Holland, produced 679.98 ounces of gold, 242 ounces of silver, and 149,274 pounds of copper, valued in all at $33,555. At the Lightning lode claim near Kerby ore was treated in a small amalgamation-gravity concentration mill. About $1,200 in gold was recovered and 300 pounds of sulphide concentrates stored. Two lode mines, the Queen of Bronze and the Cowboy, were under development in the vicinity of Waldo. The Queen of Bronze mine, on which about 500 feet of additional work were done in 1930, produced 784 tons of sorted copper sulphide ore containing 88 ounces of gold, 182 ounces of silver, and 167,686 pounds of copper. The ore sold for $17,291 with freight and treatment deducted. Ore was hauled 27 miles to Waters Creek, a station on the Southern Pacific Railroad, and shipped to Tacoma. The principal placer operations were at Waldo on the Llano De Oro property, which was equipped with two giants, each of 560 yards daily capacity. Between March and June a total of 51,000 cubic yards of material was handled, and 327 ounces of gold and some platinum metals were produced. Also, some placer gold was produced from gravels of Canyon Creek and Fry Gulch. The press release of the United States Geological Survey cited on page 1038 describes some of the geologic features of the district. Placer ground in Democrat Gulch near Holland was drilled by the Empire Exploration Co., to determine its suitability for dredging. Bullion from miscellaneous placers in the Althouse district amounted to $2,834 in gold and silver. The placer of the Althouse Mining Co. was operated by lessees, who produced about 65 ounces of gold. The Big Bend claim was under development, and a test on 15 yards of material yielded gold 0.859 fine. South of Holland the West Coast Metals Co. was preparing to operate the Joe Johnson hydraulic mine as soon as sufficient water was available.

Lower Applegate district.—The Humdinger mine near Williams in the Lower Applegate district produced a little gold from ore treated in a 2-stamp amalgamation mill, which was used in making tests. The mine is opened by three levels, two of which are adits; the third is driven from a shaft at a depth of 138 feet below the collar. Quoting from the press release cited on page 1038:

> The vein is formed along a fracture that strikes northwest and cuts beds of argillite at almost 90° to their strike. It is composed of quartz and altered country rock and, below the shallow oxidized zone, shows a little irregularly scattered pyrite. * * * Ore averaging $12 or more a ton occurs in lenslike bodies ranging from a few inches to 2½ feet or more in thickness and of considerable extent in their other dimensions.

Placer gold was recovered from 1,500 cubic yards of material worked with a No. 1 giant at Murphy on Oscar Creek.

LANE COUNTY

Bohemia district.—The Bartels Mining Co. developed some free-milling ore in one of the mines included in the Champion group in the Bohemia district in 1930 and built an amalgamation mill, which was operated a few days in December. About $250 in gold bullion was produced. Most of the mines of the district have been worked for their free-milling ores, and the future of the district must depend upon profitable exploitation of fresh sulphide ores in depth (see press release cited on p. 1038).

Fall Creek district.—The Ironsides group in the Fall Creek district was under development, and 75 tons of ore were treated in an amalgamation plant. Some sulphides are finely disseminated through the ore. The mine is 25 miles northeast of Oakridge on Christy Creek.

MARION COUNTY

North Santiam district.—The Amalgamated Mining Corporation 29 miles east of Mehama in the North Santiam district shipped 43 tons of ore to a custom selective flotation plant in Utah. This test lot of ore contained 112 ounces of silver, 1,038 pounds of copper, 3,462 pounds of lead, and 16,272 pounds of zinc; roughly calculated, it made 3 tons of lead concentrate and 14 tons of zinc concentrate. The mine is opened by a 1,340-foot tunnel, and a 100-ton concentrating plant was under construction. The ore mined consists of pyrite, galena, and sphalerite in a quartz gangue. The Crown Mining & Milling Co. drove a tunnel 35 feet and did some drifting. In the summer of 1930 a geologic reconnaissance (see press release cited on p. 1038) by the United States Geological Survey was made of part of the North Santiam district, a region for which almost no authentic information heretofore has been available.

UNION COUNTY

Medical Springs district.—The Union Mining & Milling Co., operating the Red Bird mine in the Medical Springs district, produced about 500 tons of ore; the ore was treated in a small Denver mill equipped with one Wilfley table. Some bullion and concentrates were produced and shipped. The mine is opened by a 250-foot vertical shaft with 500 feet of drifts.

WHEELER COUNTY

Spanish Gulch district.—The Gold Medal claim near Antone in the Spanish Gulch district is opened by a vertical shaft 175 feet deep and by 200 feet of drifts. It produced gold 0.834 fine from ore treated in a 2-stamp amalgamation mill on the property.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO[1]

(MINE REPORT)

By Chas. W. Henderson

CONTENTS

	Page
Summary	1047
Mining industry	1052
Ore classification	1052
Metal content of zinc-bearing materials	1052
Metallurgic industry	1053
Review by counties and districts	1057
Adams County	1057
Alamosa County	1057
Arapahoe County	1057
Archuleta County	1057
Baca County	1057
Boulder County	1057
Chaffee County	1058
Clear Creek County	1059
Costilla County	1060
Custer County	1060
Dolores County	1060
Eagle County	1061
El Paso County	1061
Fremont County	1062
Garfield County	1062
Gilpin County	1062
Review by counties and districts—Continued.	
Grand County	1063
Gunnison County	1063
Hinsdale County	1063
Lake County	1064
Leadville district	1064
Other districts	1066
La Plata County	1066
Mesa County	1067
Mineral County	1067
Moffat County	1067
Montrose County	1067
Ouray County	1068
Park County	1068
Pitkin County	1070
Rio Grande County	1071
Routt County	1071
Saguache County	1071
San Juan County	1072
San Miguel County	1074
Summit County	1075
Teller County	1076

SUMMARY

The total calculated gross value of the recovered and estimated recoverable gold, silver, copper, lead, and zinc from gravels handled and ores mined in Colorado in 1930 decreased 13 per cent from the gross value in 1929, after a decrease of 7 per cent in 1929 from the gross value in 1928. The value of gold increased 2 per cent, the value of silver decreased 28 per cent, the value of copper decreased 13 per cent, the value of lead decreased 28 per cent, and the value of zinc decreased 10 per cent. There were 313 lode mines and 21 placers producing in 1930 and 290 lode mines and 13 placers in 1929, an increase of 23 lode mines and 8 placers.

The total recorded value of gold, silver, copper, lead, and zinc (in terms of recovered metals) produced from Colorado ores and gravels from 1858 to 1930, inclusive, is $1,653,257,575.[2]

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price for 1921 and 1922 is New York market price for domestic silver only; for 1923, average price under the Pittman Act, January 1 to June 2, for domestic silver, and average New York price for all silver after that period; for 1924 and later years, average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

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[1] Work on manuscript completed April, 1932.

[2] For details 1858 to 1923 see Henderson, Charles W., Mining in Colorado: U. S. Geol. Survey Prof. Paper 138, 1926, 263 pp.; for recapitulation by years 1858 to 1925 see Gold, Silver, Copper, Lead, and Zinc in Colorado: Mineral Resources of the United States, 1925, Pt. I, opp. p. 701.

Prices of silver, copper, lead, and zinc, 1921–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1921	$1.00	$0.129	$0.045	$0.050	1926	$0.624	$0.140	$0.080	$0.075
1922	1.00	.135	.055	.057	1927	.567	.131	.063	.064
1923	.82	.147	.070	.068	1928	.585	.144	.058	.061
1924	.67	.131	.080	.065	1929	.533	.176	.063	.066
1925	.694	.142	.087	.076	1930	.385	.130	.050	.048

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1921–1930, in terms of recovered metals

Year	Mines producing			Ore sold or treated (short tons)	Gold			Silver (lode and placer)	
	Lode	Placer	Total		Lode	Placer	Total	Fine ounces	Value
1921	367	15	382	1,281,381	$6,490,688	$344,640	$6,835,328	5,631,657	$5,631,657
1922	460	20	480	1,412,100	6,017,016	356,403	6,373,419	5,855,911	5,855,911
1923	400	17	417	1,569,100	6,227,200	364,429	6,591,629	5,334,488	4,374,280
1924	340	18	358	1,514,182	8,174,610	418,506	8,593,116	3,254,370	2,180,428
1925	412	30	442	1,745,674	7,076,704	150,318	7,227,022	4,506,940	3,127,816
1926	387	31	418	1,839,740	7,031,079	46,954	7,078,033	4,704,122	2,935,372
1927	330	19	349	1,606,528	5,184,684	94,434	5,279,118	3,784,605	2,145,871
1928	336	23	359	1,426,084	5,243,470	61,406	5,304,876	4,052,253	2,370,568
1929	290	13	303	1,172,193	4,371,508	45,850	4,417,358	4,397,377	2,343,802
1930	313	21	334	1,335,731	4,379,376	138,243	4,517,619	4,382,852	1,687,398

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1921	4,153,442	$535,794	19,660,466	$884,721	2,360,000	$118,000	$14,005,500
1922	3,373,454	455,416	23,477,200	1,291,246	23,258,000	1,325,706	15,301,698
1923	4,248,109	624,472	45,698,185	3,198,873	54,152,000	3,682,336	18,471,590
1924	2,713,219	355,432	47,557,061	3,804,565	56,727,000	3,687,255	18,620,796
1925	2,360,500	335,191	62,966,000	5,478,042	61,621,000	4,683,196	20,851,267
1926	3,403,850	476,539	68,987,800	5,519,024	65,000,000	4,875,000	20,883,968
1927	5,670,581	742,846	66,772,557	4,206,671	71,729,000	4,590,656	16,965,162
1928	8,594,646	1,237,629	53,501,723	3,103,100	71,462,000	4,359,182	16,375,355
1929	8,905,074	1,567,293	48,889,906	3,080,064	58,861,000	3,884,826	15,293,343
1930	10,514,000	1,366,820	44,260,000	2,213,000	72,518,000	3,480,864	13,265,701

Gold and silver produced at placer mines in Colorado, 1921–1930, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Dredging		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
1921	323.63	96	16,348.32	4,346	16,671.95	4,442
1922	487.43	128	16,753.57	4,100	17,241.00	4,228
1923	269.22	66	17,360.03	4,056	17,629.25	4,122
1924	310.85	81	19,934.38	4,873	20,245.23	4,954
1925	445.77	101	6,825.86	1,798	7,271.63	1,899
1926	391.54	67	1,879.86	502	2,271.40	569
1927	364.38	73	4,203.87	1,063	4,568.25	1,136
1928	502.45	100	2,468.06	628	2,970.51	728
1929	355.72	60	1,862.27	488	2,217.99	548
1930	358.90	57	6,328.61	1,600	6,687.51	1,657

GOLD

The production of gold in Colorado in 1930, in terms of recovered metal, was 218,539.82 fine ounces, valued at $4,517,619, an increase from 1929 of 4,850.13 ounces ($100,261).

The Cripple Creek district contributed $2,532,032 (56 per cent of the total yield). The part of the San Juan region that includes Dolores, La Plata, Ouray, Rio Grande, San Juan, and San Miguel Counties yielded $881,943 (19½ per cent of the State total). The largest increases were $245,345 in Park County, $229,972 in San Juan, $88,310 in Summit, $45,138 in Eagle, $30,421 in Gilpin, $9,128 in Clear Creek, and $8,547 in Gunnison. The largest decreases were $219,214 in Ouray County, $108,002 in Teller, $107,878 in La Plata, $33,755 in Lake, $29,701 in San Miguel, $25,192 in Rio Grande, $17,012 in Boulder, $9,670 in Saguache, and $4,261 in Dolores.

The yield of placer gold was $138,243, an increase of $92,393 over 1929. Summit County, with 1 dredge, 1 hydraulic mine, and 5 sluice mines, produced 96 per cent of the placer gold. The other counties producing placer gold in 1930 were Adams, Arapahoe, Chaffee, Gilpin, Montrose, and Park.

SILVER

The production of silver in Colorado in 1930, in terms of recovered metal, was 4,382,852 fine ounces, valued at $1,687,398, a decrease of 14,525 ounces and $656,404 from 1929, after an increase of 345,124 ounces and a decrease of $26,766 from 1928. Dolores, La Plata, Mineral, Ouray, Rio Grande, San Juan, and San Miguel Counties, of the San Juan region, and Saguache County, geologically an outlier of the San Juan Tertiary flows, produced 1,988,826 ounces, valued at $765,698 (45 per cent of the State total). In 1929 these same counties produced 2,716,846 ounces, valued at $1,448,079 (62 per cent of the State total). In 1930 Eagle County produced 37 per cent, San Juan 24 per cent, Lake 14 per cent, Mineral 9 per cent, and Saguache 8 per cent of the State total. The largest increases were 703,403 ounces in Eagle County, 222,530 ounces in Lake, and 195,952 ounces in San Juan. The largest decreases were 388,597 ounces in Saguache County, 216,453 ounces in Mineral, 190,307 ounces in Dolores, 130,294 ounces in Clear Creek, 80,138 ounces in La Plata, 40,097 ounces in San Miguel, and 33,358 ounces in Pitkin.

COPPER

The production of recoverable copper in Colorado in 1930 was 10,514,000 pounds, valued at $1,366,820, a decrease of $200,473 from 1929, after an increase of $329,664 over 1928. Eagle County produced 56 per cent of the copper output, San Juan over 25 per cent, Saguache nearly 12 per cent, Dolores 3 per cent, and Lake 2 per cent. The combined output of the seven other counties producing copper was less than 2 per cent of the State total in 1930. Eagle County increased its production from 3,139,000 pounds, valued at $552,464, in 1929 to 5,849,000 pounds, valued at $760,370, in 1930; San Juan County gained 521,000 pounds in production but lost $31,492 in value; and Park County increased 6,407 pounds in production and $755 in value. The largest decreases were 1,433,000 pounds and

$308,972 in Saguache County, 65,096 pounds and $23,049 in Lake, 27,171 pounds and $5,978 in Ouray, 18,472 pounds and $4,309 in Clear Creek, and 18,250 pounds and $17,426 in Dolores.

LEAD

The production of recoverable lead in Colorado in 1930, reckoned as lead in lead bullion and in leaded zinc oxide, was 44,260,000 pounds, valued at $2,213,000, a decrease of $867,064 from 1929. There were decreases in all the important lead-producing counties except Eagle, which increased 5,247,000 pounds in production and $257,215 in value; also Lake, Park, and Ouray Counties increased in both quantity and value of output. Lead ores yielded 3,446,760 pounds and lead-zinc ores 33,499,800 pounds. Smelting ores of all kinds yielded 6,505,193 pounds, and concentrates of all kinds smelted yielded 37,754,807 pounds.

ZINC

The zinc-bearing ores marketed from Colorado in 1930 contained 72,518,000 pounds of recoverable zinc, valued at $3,480,864, an increase of 13,657,000 pounds and a decrease of $403,962 from 1929. Eagle County led in zinc production in 1930 with 28,544,000 pounds (39 per cent of the zinc output of the State), compared with 840,000 pounds (1.4 per cent) in 1929. Lake County ranked second in 1930 with 23,038,000 pounds (32 per cent of the total), compared with 26,828,000 pounds (46 per cent) in 1929. San Juan County ranked third in 1930 with 19,677,000 pounds (27 per cent of the total), compared with 22,858,000 (39 per cent) in 1929. Of the larger zinc-producing counties, Dolores decreased its output of zinc 4,715,000 pounds, Lake 3,790,000 pounds, and San Juan 3,181,000 pounds; Summit produced no zinc, compared with 1,930,000 pounds in 1929.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1930, by counties, in terms of recovered metals

County	Mines producing			Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Total	Fine ounces	Value	Fine ounces	Value
Adams		2	2	102.80	$2,125	13	$5
Arapahoe		1	1	5.03	104		
Boulder	36		36	798.96	16,516	3,304	1,272
Chaffee	3	3	6	76.14	1,574	1,348	519
Clear Creek	47		47	4,941.07	102,141	38,556	14,844
Dolores	13		13	416.27	8,605	82,678	31,831
Eagle	4		4	5,666.31	117,133	1,620,574	623,921
Gilpin	25	6	31	6,758.47	139,710	21,696	8,353
Gunnison	6		6	809.94	16,743	2,265	872
Lake	42		42	5,044.35	104,276	616,800	237,468
La Plata	12		12	410.32	8,482	2,969	1,143
Mineral	5		5	114.36	2,364	396,044	152,477
Moffat	1		1	.34	7	52	20
Montrose		1	1	1.55	32		
Ouray	8		8	7,226.45	149,384	18,122	6,977
Park	7	1	8	21,872.37	452,142	11,709	4,508
Pitkin	7		7	4.74	98	65,522	25,226
Rio Grande	2		2	415.54	8,590	239	92
Saguache	3		3	550.17	11,373	333,722	128,483
San Juan	12		12	31,994.06	661,376	1,067,496	410,986
San Miguel	12		12	2,201.35	45,506	87,556	33,709
Summit	5	7	12	6,642.18	137,306	3,496	1,346
Teller	63		63	122,487.05	2,532,032	8,691	3,346
	313	21	334	218,539.82	4,517,619	4,382,852	1,687,398
Total, 1929	290	13	303	213,689.69	4,417,358	4,397,377	2,343,802

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1930, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$2, 130
Arapahoe							104
Boulder			4, 900	$245			18, 033
Chaffee	1, 500	$195	44, 000	2, 200			4, 488
Clear Creek	23, 000	2, 990	184, 500	9, 225	21, 000	$1, 008	130, 208
Dolores	309, 000	40, 170	1, 355, 200	67, 760	1, 190, 000	57, 120	205, 486
Eagle	5, 849, 000	760, 370	5, 642, 000	282, 100	28, 544, 000	1, 370, 112	3, 153, 636
Gilpin	90, 300	11, 739	94, 300	4, 715	7, 000	336	164, 853
Gunnison			35, 600	1, 780	41, 000	1, 968	21, 363
Lake	252, 000	32, 760	13, 626, 000	681, 300	23, 038, 000	1, 105, 824	2, 161, 628
La Plata			600	30			9, 655
Mineral			148, 600	7, 430			162, 271
Moffat	9, 000	1, 170					1, 197
Montrose							32
Ouray	26, 000	3, 380	171, 000	8, 550			168, 291
Park	8, 100	1, 053	328, 800	16, 440			474, 143
Pitkin			795, 000	39, 750			65, 074
Rio Grande			1, 500	75			8, 757
Saguache	1, 234, 000	160, 420	2, 343, 000	117, 150			417, 426
San Juan	2, 678, 000	348, 140	17, 788, 600	889, 430	19, 677, 000	944, 496	3, 254, 428
San Miguel	34, 100	4, 433	1, 637, 800	81, 890			165, 538
Summit			58, 600	2, 930			141, 582
Teller							2, 535, 378
	10, 514, 000	1, 366, 820	44, 260, 000	2, 213, 000	72, 518, 000	3, 480, 864	13, 265, 701
Total, 1929	8, 905, 074	1, 567, 293	48, 889, 906	3, 080, 064	58, 861, 000	3, 884, 826	15, 293, 343

Gold and silver produced at lode and placer mines in Colorado in 1930, by counties, in terms of recovered metals

County	Lode mines					Placer mines				Grand total value
	Ore sold or treated	Gold	Silver		Total value	Gold	Silver		Total value	
	Short tons		*Fine ounces*				*Fine ounces*			
Adams						$2, 125	13	$5	$2, 130	$2, 130
Arapahoe						104			104	104
Boulder	746	$16, 516	3, 304	$1, 272	$17, 788					17, 788
Chaffee	169	1, 137	1, 348	519	1. 656	437			437	2, 093
Clear Creek	24, 965	102, 141	38, 556	14, 844	116, 985					116, 985
Dolores	7, 958	8, 605	82, 678	31, 831	40, 436					40, 436
Eagle	237, 769	117, 133	1, 620, 574	623, 921	741, 054					741, 054
Gilpin	132, 346	136, 941	21, 670	8, 343	145, 284	2. 769	26	10	2, 779	148, 063
Gunnison	290	16, 743	2, 265	872	17, 615					17, 615
Lake	131, 202	104, 276	616, 800	237, 468	341, 744					341, 744
La Plata	272	8, 482	2, 969	1, 143	9, 625					9, 625
Mineral	4, 576	2, 364	396, 044	152, 477	154, 841					154, 841
Moffat	25	7	52	20	27					27
Montrose						32			32	32
Ouray	15, 700	149, 384	18, 122	6, 977	156, 361					156, 361
Park	5, 134	452, 042	11, 709	4, 508	456, 550	100			100	456, 650
Pitkin	7, 503	98	65, 522	25, 226	25, 324					25, 324
Rio Grande	169	8, 590	239	92	8, 682					8, 682
Saguache	56, 503	11, 373	333, 722	128, 483	139, 856					139, 856
San Juan	403, 801	661, 376	1, 067, 496	410, 986	1, 072, 362					1, 072, 362
San Miguel	13, 393	45, 506	87, 556	33, 709	79, 215					79, 215
Summit	5, 131	4, 630	1, 878	723	5, 353	132, 676	1, 618	623	133, 299	138, 652
Teller	288, 079	2, 532, 032	8, 691	3, 346	2, 535, 378					2, 535, 378
	1, 335, 731	4, 379, 376	4, 381, 195	1, 686, 760	6, 066, 136	138, 243	1, 657	638	138, 881	6, 205, 017
Total, 1929	1, 172, 193	4, 371, 508	4, 396, 829	2, 343, 510	6, 715, 018	45, 850	548	292	46, 142	6, 761, 160

Gold and silver produced at placer mines in Colorado in 1930, by counties, in fine ounces

County	Sluicing and hydraulic		Dredging		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Adams	102.80	13			102.80	13
Arapahoe	5.03				5.03	
Chaffee	21.14				21.14	
Gilpin	133.95	26			133.95	26
Montrose	1.55				1.55	
Park	4.84				4.84	
Summit	89.59	18	6,328.61	1,600	6,418.20	1,618
	358.90	57	6,328.61	1,600	6,687.51	1,657
Total, 1929	355.72	60	1,862.27	488	2,217.99	548

MINING INDUSTRY

Operating details are given under Review by Counties and Districts, page 1057, and significant statistical details are given in the tables throughout the report. Important operating details of mining in Colorado were reviewed in the press notice, "Metal Mining in Colorado, 1930," released by the Bureau of Mines January 9, 1931.

ORE CLASSIFICATION

Ore sold or treated in Colorado in 1930, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	470,208	170,111.15	79,509	116,454	551,280	
Dry gold-silver ore	140,785	23,409.66	452,699	1,262,030	1,694,840	
Dry silver ore	99,498	853.36	1,095,944	1,341,880	4,636,320	
	710,491	194,374.17	1,628,152	2,720,364	6,882,440	
Copper ore	63,915	4,675.33	1,484,589	5,953,000	431,000	
Lead ore	20,482	2,222.68	178,054	64,067	3,446,760	
Lead-zinc ore	540,843	10,580.13	1,090,400	1,776,569	33,499,800	72,518,000
	625,240	17,478.14	2,753,043	7,793,636	37,377,560	72,518,000
Total, lode mines	1,335,731	211,852.31	4,381,195	10,514,000	44,260,000	72,518,000
Total, placers		6,687.51	1,657			
	1,335,731	218,539.82	4,382,852	10,514,000	44,260,000	72,518,000
Total, 1929	1,172,193	213,689.69	4,397,377	8,905,074	48,889,906	58,861,000

METAL CONTENT OF ZINC-BEARING MATERIALS

The following table lists the kind and grade of zinc-bearing materials marketed in 1930.

Zinc-lead ore and zinc concentrates as marketed from Colorado mines and mills in 1930, in terms of original content

Classification	County	Dry weight	Gold		Silver	
			Content	Average assay	Content	Average assay
		Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Sulphide:						
Crude milling ore and middlings.	Dolores, Gunnison, and San Juan.	9, 716	1, 253. 40	0. 129	73, 857	7. 60
Crude milling and smelting ore.	Lake	13, 188	531. 78	. 040	51, 984	3. 94
Crude milling ore	Clear Creek and Gilpin	539	361. 12	. 670	4, 542	8. 43
Total crude milling and smelting ore and middlings.		23, 443	2, 146. 30	. 092	130, 383	5. 56
Zinc concentrates	Eagle, Lake, and San Juan.	78, 618	2, 382. 22	. 030	295, 465	3. 76
Grand total		102, 061	4, 528. 52		425, 848	

Classification	Copper		Lead		Zinc	
	Content	Wet assay	Content	Wet assay	Content	Assay
	Pounds	*Per cent*	*Pounds*	*Per cent*	*Pounds*	*Per cent*
Sulphide:						
Crude milling ore and middlings	198, 243	1. 02	2, 098, 566	10. 80	2, 865, 559	14. 75
Crude milling and smelting ore	5, 383	. 02	2, 434, 534	9. 23	5, 510, 651	20. 89
Crude milling ore	5, 986	. 55	136, 190	12. 63	79, 003	7. 33
Total crude milling and smelting ore and middlings	209, 612	. 45	4, 669, 290	9. 96	8, 455, 213	18. 03
Zinc concentrates	751, 486	. 48	4, 386, 887	2. 79	79, 607, 194	50. 63
Grand total	961, 098		9, 056, 177		88, 062, 407	

METALLURGIC INDUSTRY

Details of the metallurgic industry of the State are amply shown in the tables that follow. Virtually all the concentrates from Colorado indicated herein were recovered by flotation and hence need not be divided by methods of recovery.

Gross metal content of concentrates produced from ores mined in Colorado in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper (wet assay)	Lead (wet assay)	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	1, 188	2, 015. 46	12, 212	78, 730	23, 280	337, 413
Dry gold and silver	3, 748	4, 424. 79	118, 312	59, 408	342, 251	525, 933
Copper	58	76. 60	853	5, 373	1, 848	696
Copper-lead	30, 600	25, 751. 40	1, 139, 200	4, 414, 690	19, 366, 290	4, 689, 661
Lead	21, 788	6, 812. 62	528, 730	428, 258	21, 652, 449	3, 873, 018
Lead-zinc	1, 334	133. 40	17, 822	49, 624	437, 552	658, 996
Zinc	80, 018	2, 395. 67	298, 495	767, 850	4, 459, 752	81, 046, 662
	138, 734	41, 609. 94	2, 115, 624	5, 803, 933	46, 283, 422	91, 132, 379
Total, 1929	133, 220	37, 867. 71	2, 462, 367	7, 007, 234	47, 546, 249	77, 790, 609

Mine production of metals in Colorado in 1930, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	402, 465	49, 797. 63	7, 373			
Ore, concentrates, sands, and slimes cyanided	311, 657	96, 998. 01	196, 895			
Concentrates smelted	138, 734	40, 856. 96	2, 017, 247	4, 388, 653	37, 754, 807	68, 231, 000
Ore smelted	126, 094	24, 190. 71	2, 159, 680	6, 125, 347	6, 505, 193	4, 287, 000
Placer		6, 687. 51	1, 657			
		218, 530. 82	4, 382, 852	10, 514, 000	44, 260, 000	72, 518, 000
Total, 1929		213, 689. 69	4, 397, 377	8, 905, 074	48, 889, 908	58, 891, 000

Ore treated by amalgamation, ore, concentrates, sands, and slimes treated by cyanidation, and gold and silver contained in bullion and precipitates in Colorado in 1930

Process	Material treated	Gold in bullion	Silver in bullion	Quicksilver purchased	Sodium cyanide used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amalgamation	402, 465	49, 797. 63	7, 373	2, 005	
Cyanidation	311, 657	96, 998. 01	196, 895		[1] 316, 240
		146, 795. 64	204, 268	2, 005	[1] 316, 240

[1] Reduced to equivalent of 96 to 98 per cent strength. Actually 621,868 pounds of cyanamid of approximately 48 to 49 per cent strength and 5,306 pounds of sodium cyanide of 96 to 98 per cent strength.

Mine production of metals from gold and silver mills in Colorado in 1930, by counties, in terms of recovered metals

County	Ore treated	Recovered in bullion		Concentrates and recovered metal					
		Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	746	790. 01	3, 146	9	8. 95	158		4, 900	
Chaffee	49	42. 23	57						
Clear Creek	23, 972	3, 769. 39	19, 411	201	838. 76	4, 967	9, 400	90, 300	21, 000
Eagle		. 29							
Gilpin	132, 167	4, 539. 80	5, 936	1, 254	2, 041. 23	13, 020	65, 200	61, 340	7, 000
Gunnison	143	724. 17	1, 505						
Lake	1, 520	2, 174. 97	4, 690	197	46. 26	579	1, 600	43, 900	67, 000
La Plata		107. 21	40						
Mineral	2, 551	67. 87	155, 796	106	27. 99	41, 493		57, 400	
Ouray	14, 009	5, 041. 96	1, 644	621	2, 142. 90	8, 365	16, 000	117, 000	
Park	2, 114	5, 061. 89	2, 474	100	2, 012. 95	484	4, 700	54, 000	
Rio Grande	19	345. 97							
Saguache	14	65. 17	61						
San Juan		279. 66	151						
San Miguel	250	1, 086. 34	505	13	30. 70	60		700	
Summit	5, 001	211. 66	161						
Teller	288, 079	122, 487. 05	8, 691						
	470, 634	146, 795. 64	204, 268	2, 501	7, 142. 74	69, 126	96, 900	429, 540	95, 000
Total, 1929	378, 056	152, 862. 88	52, 959	2, 898	7, 649. 28	45, 035	140, 532	229, 753	

Mine production of metals from concentrating mills in Colorado in 1930, by counties, in terms of recovered metals

County	Ore treated	Concentrates and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clear Creek	630	63	78.18	1,113	4,300	3,300	
Dolores	5,442	2,401	83.35	29,797	52,000	1,130,200	1,190,000
Eagle	175,646	42,546	1,026.69	151,106	176,000	5,220,000	28,544,000
Lake	81,767	31,360	287.80	279,348	134,000	9,327,000	18,727,000
La Plata	160	15	48.31	887		600	
Ouray	1,650	177	38.99	7,702	8,000	51,000	
Park	140	7	24.09	58	100	1,600	
Pitkin	600	25		3,500		25,000	
Rio Grande	150	4	24.14	239		1,500	
Saguache	56,262	7,737	456.00	328,384	1,216,000	2,236,000	
San Juan	403,556	50,102	31,568.12	1,063,325	2,668,353	17,734,067	19,677,000
San Miguel	13,000	1,796	71.55	82,662	33,000	1,595,000	
	739,003	136,233	33,707.22	1,948,121	4,291,753	37,325,267	68,138,000
Total, 1929	692,664	130,322	30,104.79	2,373,446	5,330,706	41,437,162	56,370,000

Mine production of metals from Colorado concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	9	8.95	158		4,900	
Clear Creek	264	916.94	6,080	13,700	93,600	21,000
Dolores	2,401	83.35	29,797	52,000	1,130,200	1,190,000
Eagle	42,546	1,026.69	151,106	176,000	5,220,000	28,544,000
Gilpin	1,254	2,041.23	13,020	65,200	61,340	7,000
Lake	31,557	334.06	279,927	135,600	9,370,900	18,794,000
La Plata	15	48.31	887		600	
Mineral	106	27.99	41,493		57,400	
Ouray	798	2,181.89	16,067	24,000	168,000	
Park	107	2,037.04	542	4,800	55,600	
Pitkin	25		3,500		25,000	
Rio Grande	4	24.14	239		1,500	
Saguache	7,737	456.00	328,384	1,216,000	2,236,000	
San Juan	50,102	31,568.12	1,063,325	2,668,353	17,734,067	19,677,000
San Miguel	1,809	102.25	82,722	33,000	1,595,700	
	138,734	40,856.96	2,017,247	4,388,653	37,754,807	68,233,000
Total, 1929	133,220	37,754.07	2,418,481	5,471,238	41,666,915	56,370,000

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	1,188	2,015.46	12,212	63,000	21,840	
Dry gold and silver	3,748	4,424.79	118,312	47,526	307,800	298,506
Copper	58	76.60	853	4,300	1,700	
Copper-lead	30,600	25,751.40	1,139,200	3,531,213	17,429,237	448,900
Lead	21,788	6,812.62	528,729	330,238	16,692,330	
Total to copper and lead plants	57,382	39,080.87	1,799,306	3,976,277	34,452,907	747,406
Lead-zinc	1,334	133.40	17,822	39,700	393,800	379,594
Zinc	80,018	1,642.69	200,119	372,676	2,908,100	67,106,000
Total to zinc and lead plants	81,352	[1] 1,776.09	[1] 217,941	[1] 412,376	[2] 3,301,900	[3] 67,485,594
	138,734	40,856.96	2,017,247	4,388,653	37,754,807	68,233,000

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[1] Recovered in zinc residues.
[2] Lead recovered in zinc residues and leaded zinc oxide.
[3] Zinc recovered as metal and zinc in zinc oxide.

Gross metal content of Colorado crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Ore		Gross metal content				
			Gold	Silver	Copper	Lead	Zinc
	Short tons	*Per cent*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	4,133	3.28	17,085.40	21,557	25,452	348,291	317,136
Dry gold and silver	128	.10	88.40	4,588	4,850	16,982	10,452
Dry silver	38,567	30.58	330.03	555,484	147,319	2,145,440	2,855,666
Copper	63,915	50.69	4,675.33	1,484,589	6,203,458	862,000	742,280
Lead	7,111	5.64	2,020.55	95,368	39,038	2,015,232	392,737
Lead zinc	12,240	9.71	363.78	48,598		2,356,824	5,555,859
	126,094	100.00	24,563.49	2,208,184	6,419,967	8,144,715	9,878,110
Total, 1929	101,473		21,018.71	1,947,271	3,723,982	8,478,715	6,462,734

Mine production of metals from Colorado crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Chaffee	120	12.77	1,294	1,500	43,000	
Clear Creek	263	254.74	13,065	9,300	90,900	
Dolores	2,516	332.92	52,881	257,000	225,000	
Eagle	62,123	1,639.33	1,469,468	5,673,000	422,000	
Gilpin	179	43.49	2,714	25,100	52,900	
Gunnison	147	85.77	760		35,600	41,000
Lake	47,915	2,533.32	332,183	116,400	4,255,100	4,244,000
La Plata	112	254.80	2,042			
Mineral	2,025	18.50	198,755		91,200	
Moffat	25	.34	52	9,000		
Ouray	41	2.60	411	2,000	3,000	
Park	2,880	14,768.60	8,693	3,300	273,200	
Pitkin	6,903	4.74	62,022		770,000	
Rio Grande		45.43				
Saguache	227	29.00	5,277	18,000	107,000	
San Juan	245	146.28	4,020	9,047	54,393	
San Miguel	143	1,012.76	4,329	1,100	42,100	
Summit	130	12.32	1,717	[illegible]	58,000	
	126,094	24,199.71	2,159,680	6,125,347	6,505,193	4,285,000
Total, 1929	101,473	20,854.75	1,925,389	3,433,856	7,222,991	2,491,000

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry gold	4,133	17,085.40	21,557	19,554	315,140	
Dry gold and silver	128	88.40	4,588	3,846	15,173	
Dry silver	38,567	330.03	555,484	117,880	2,288,920	
Copper	63,915	4,675.33	1,484,589	5,953,000	431,000	
Lead	7,111	2,020.55	95,368	31,067	1,808,060	
Total to copper and lead plants	113,854	24,199.71	2,159,586	6,125,347	4,858,293	
Lead-zinc	12,240		94		1,646,900	4,285,000
Total to zinc smelters and zinc oxide plants	12,240		[1] 94		[2] 1,646,900	[3] 4,285,000
	126,094	24,199.71	2,159,680	6,125,347	6,505,193	4,285,000

[1] Recovered in zinc residues.

[2] Lead recovered in zinc residues and leaded zinc oxide.

[3] Zinc recovered as metal and zinc in leaded zinc oxide.

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

Sluice boxes placed below the waste flumes of the Brannan and Gordon sand and gravel plants on Clear Creek recovered $2,125 in gold and 13 ounces of silver in 1930. The average yearly fineness of the Brannan yield after being melted at the Denver Mint was 0.878 in gold and 0.119 in silver, and that of the Gordon yield 0.759 in gold and 0.113 in silver. From 1922, when the sluices were first placed below these and other gravel and sand plants, to 1930, inclusive, $21,470 in gold and 154 ounces of silver have been recovered. Production of the county before 1922 is covered in the 1928 report of this series.

ALAMOSA COUNTY

Development work was continued in 1930 at the Red Eagle prospect in the West Blanca district.

ARAPAHOE COUNTY

F. D. Goody, with a portable gold-saving machine, extracted 5 ounces of gold from the treatment of gravel from the Platte River in Arapahoe County.

ARCHULETA COUNTY

Assessment work was continued at the Treasure Comstock prospect in T. 36 N., R. 3 E., New Mexico principal meridian, and west of Summitville. The mineralization is lead-zinc-silver-gold-copper sulphide, replacing limestone beds.

BACA COUNTY

Assessment work was continued at the Independence prospect near Utleyville. Production from this region in the past has been from rounded nodules of chalcocite in a white sandstone.

BOULDER COUNTY

Central district (Jamestown).—In 1930 five mines near Jamestown produced 233 tons of ore yielding $3,740 in gold, 265 ounces of silver, and 3,400 pounds of lead. From the Cracker Jack mine, opened by a vertical shaft 140 feet deep and an adit 140 feet long, 195 tons of dry gold and silver ore were shipped to the Golden Cycle mill at Colorado Springs. In addition, the General Mines Corporation took over the " Red Diamond " amalgamation-flotation mill late in 1930, and started the mill on ore from the Cracker Jack. The results of this run were not known until 1931. J. H. Hardy shipped 10 tons of gold ore from the Buckhorn, and William Walker shipped 10 tons of gold ore from the Walker to the Golden Cycle mill at Colorado Springs. In the treatment of fluorspar ore from the Argo-Emmett property 16 tons of lead-gold-silver concentrates were recovered as a by-product. A 2-ton lot of gold ore was shipped from the Stanley property.

Gold Hill district.—The total output from the Gold Hill district in 1930 was 228 tons of ore containing 132.04 ounces of gold and 943 ounces of silver. Small lots of ore from various properties aggregated 44 tons, containing 69.47 ounces of gold and 709 ounces of silver, which were sold to the Golden Cycle mill. Ninety-four tons of gold ore were shipped from the Emancipation mine. In the course of development work by the United Mines Co. on a group in sec. 8, T. 1 N., R. 71 W., 90 tons of gold ore were extracted and shipped; the company is developing this group of properties by an adit (2,200 feet long at the end of 1930), of which 600 feet were driven during the year; in addition there are five shafts, ranging from 250 to 600 feet in depth.

Grand Island district (*Cardinal*, *Caribou*, *Eldora*, *and Nederland*).—Two lots of gold ore from the Boulder County mine totaled 21 tons and contained 27.99 ounces of gold and 96 ounces of silver. The Potosi-Caribou Mining Co. completed its amalgamation-flotation mill in 1930 and made a test run from the Potosi mine. The equipment of this mill is as follows: 60 Straub stamps, 6 amalgamation plates, 1 screen, 1 Marcy ball mill, Wilfley tables, and 3 Fahrenwald 6-cell flotation machines. As a result of this test run 10 tons of lead concentrates, containing 29.07 ounces of gold, 847 ounces of silver, and 3,360 pounds of lead, and gold-silver bullion, containing 9.08 ounces of gold and 13 ounces of silver, were marketed. The Potosi is opened by an inclined 500-foot shaft.

Magnolia district.—In the Magnolia district, which ordinarily yields small lots of gold ore, only 682 pounds were produced in 1930. This ore came from the Washington lode and was not settled for until 1931.

Sugar Loaf district.—Fourteen properties in the Sugar Loaf district in 1930 produced bullion from small hand mortars and 193 tons of gold-silver ore, the combined bullion and ore carrying 382.74 ounces of gold and 1,449 ounces of silver. Producing properties were the Clipper, Dime, Gladys, Gold Brick, Homestead, Liberty, Livingston, Logan, Nancy, Paymaster, Red Signe, Tambourine, Wood Mountain, and Yellow Pine.

Ward district.—Several properties in the Ward district in 1930 produced 61 tons of ore containing 58.35 ounces of gold and 160 ounces of silver.

CHAFFEE COUNTY

Chalk Creek district (*Romley*).—The Mary Murphy mine and mill in the Chalk Creek district remained idle in 1930. At the Matilda group the operators built 2,000 feet of road and drove 200 feet of adit in 1930, making the total underground development work on the property one adit 210 feet and one adit 65 feet. A 2-ton test lot of ore was shipped to the Golden Cycle mill. At the Sitting Bull (Avalon and Greenback claims) assessment work was done, and 1½ miles of road having a 6 per cent grade were constructed.

Granite district.—In 1930 the general merchandise store at Granite exchanged merchandise for 7.24 ounces of placer gold mined in the vicinity; the bullion when melted at the Denver Mint averaged 0.837 fineness in gold and 0.157 fineness in silver. In addition, 11.07 ounces of placer gold were shipped to the Denver Mint from the vicinity of Granite; the bullion when melted at the mint weighed 10.59 ounces averaging 0.780 fineness in gold and 0.214 fineness in silver. Sluicing at the Arkansas River between Granite and Buena

Vista recovered 9 ounces of placer bullion containing approximately 7.2 ounces of gold.

At the Granite Tunnel property 2 miles northeast of Granite the H. & H. Mining Co. continued development work throughout 1930 with 6 to 8 men and shipped one car of gold ore to the Golden Cycle mill. Drifts on the vein totaled 1,000 feet, and a 75-foot raise was driven. At the end of 1930 development consisted of a 2,054-foot adit and about 2,000 feet of drifts. Thirty feet of development work were done on the Mayflower claim in 1930.

Monarch-Garfield district.—A lessee on the Madonna mine shipped 120 tons of lead-copper-[zinc]-silver-gold oxidized ore to the Leadville smelter.

CLEAR CREEK COUNTY

Alice district (*Yankee, Lincoln*).—A 2-ton lot of gold ore was shipped to the Golden Cycle mill from the Blizzard claim. George A. Reynolds treated 2 tons of gold ore in the stamp mill on his property and recovered $10 in gold bullion from the plates. His claims—the Champion group—are developed by 2,000 feet of adits and drifts. A lessee on the Lombard property shipped 62 tons of mixed ore and stored concentrates to the Golden Cycle mill; this material contained 154.91 ounces of gold, 253 ounces of silver, 6,532 pounds of lead, and 11,886 pounds of zinc.

Empire district.—Five mines in the Empire district shipped 244 tons of ore, containing 159.99 ounces of gold and 132 ounces of silver, to the Golden Cycle mill. Producing mines were the Benton, Cashier, Liberty, Mint, and Wood. At the Atlantic property 30 feet of development work were done, changes were made in the mill equipment, and the 10-ton concentration mill was operated for a short time as a test run.

Griffith district (*Georgetown-Silver Plume*).—In 1930 five mines in the Georgetown-Silver Plume district produced 825 tons of ore yielding $3,033 in gold, 8,948 ounces of silver, 9,800 pounds of copper, and 26,700 pounds of lead, in terms of recovered metals, with a gross calculated value for the four metals of $9,087, compared with six mines yielding gold, silver, copper, lead, and zinc valued at $86,562 in 1929. To the Golden Cycle mill were shipped a 4-ton lot of silver ore from the Baltimore, a 53-ton lot of gold and silver ore from the St. George, and a 49-ton lot of dry silver ore by Lew Thomas. The Western States Mining Co., operating the Centennial mine, ran its 90-ton flotation mill for a short time and produced several cars of copper-lead-silver-gold concentrates. Operators of the East Griffith mine shipped approximately seven narrow-gage cars of lead-[zinc]-copper-silver-gold ore to the Leadville smelter.

Idaho Springs district.—Twenty-seven mines in the Idaho Springs district produced 23,642 tons of ore yielding $92,313 in gold, 27,956 ounces of silver, 13,000 pounds of copper, 123,000 pounds of lead, and 14,000 pounds of zinc, with a total gross calculated value for the five metals of $111,588, compared with 16 mines yielding gold, silver, copper, and lead valued at $82,104 in 1929 and 25 mines yielding gold, silver, copper, and lead valued at $24,479 in 1928. Important producing mines in 1930 were the Black Eagle, Brighton, Idaho Bride, Lincoln, Mattie, and West Gold. Other producing mines were the Alexander, Calvin, Columbine, Dexter, Edwards, Esmeralda, Fulton, Kangaroo, Kobold, Last Hope, Torpedo, Treasure Vault, and Washington. The Mattie 100-ton amalgamation-concentration mill was operated part of the year. The products were amalgamation gold-silver bullion, sold to the Denver Mint, and lead-silver-gold concentrates, the bulk of which was sold to the Golden Cycle mill and the remainder to the Leadville smelter. At the end of 1930 the Mattie mine was opened by a vertical shaft 1,100 feet deep, 3,400 feet of drifts, and a 3,800-foot adit. During 1930 the shaft was sunk 100 feet, and 500 feet of drifting were done. Several new stopes were also opened. A 150-ton Ruth rod mill and one Ruth cleaner flotation machine were added to the equipment of the mill, which was described in the 1929 report of this series. The North American Mining Co. kept the Big Five power plant and tunnel transportation facilities in order for service to lessees. The only development work done on the property was on the Fulton mine at the Central (or Big Five) Tunnel level and amounted to 50 feet of drifts and 43 feet of raises; a small test shipment was taken out and sold to the Golden Cycle mill. The Edgar mine was kept unwatered, and 250 feet of retimbering were done. Timbering and track repairs were continued on the Central Tunnel. At the West Gold property in 1930 a 75-ton cyanidation plant was built; it was operated at an average of 55 tons a day for 221 days. The production was gold-silver-cyanidation precipitates, sold to the Denver Mint. The equipment of the mill is as follows: One Wheeling 9 by 16 inch crusher; two Colorado Iron Works ball mills—one 4 by 10 foot and one 5 by 5 foot; two 48-inch Akins classifiers; one No. 7 Wilfley table; one Portland filter; three 15 by 16 foot agitation tanks; one 6 by 12 foot leaching tank; four 8 by 28 foot thickening tanks; four solution tanks—two 5 by 12 foot and two 12 by 12 foot; and two 6 by 11 foot sump tanks.

Montana district (Lawson, Dumont).—Five mines in the Montana district in 1930 produced 115 tons of ore yielding $327 in gold, 844 ounces of silver, 200 pounds of copper, and 4,900 pounds of lead, with a total gross calculated value for the four metals of $923, compared with seven mines yielding $7,795 in 1929. Producing mines in 1930 were the Mattie Jack, Murray, Phoenix, Platts, and Princess of India.

Trail Creek district (Lamartine, Freeland).—Shipments of ore from the Trail Creek district to the Golden Cycle mill in 1930 were 43 tons of lead-zinc-silver-gold ore from the Crazy Girl mine and 32 tons of gold-silver ore from the United Freeland mine.

COSTILLA COUNTY

Plomo (or Rito Seco) district.[3]—In 1930 sampling of the Plomo area was in progress.

CUSTER COUNTY

There was no production in Custer County in 1930.

DOLORES COUNTY

The total gross calculated value of the estimated recoverable gold, silver, copper, lead, and zinc from ore mined and sold from mines in Dolores County in 1930 (nearly all from Rico) was $205,486, compared with $1,050,476 in 1929, $1,448,777 in 1928, $1,432,554 in 1927, $990,281 in 1926, $353,563 in 1925, and $24,220 in 1924.

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[3] Gunther, C. G., The Gold Deposits of Plomo, San Luis Park, Colo.: Econ. Geol., vol. 1, 1905, pp. 143-154.

Lone Cone district (*Dunton*).—At the old Emma mine, reopened in 1928–29, no new development work was done in 1930. The mine and mill were run part time from June 15 until September 1. An 8-ton lot of gold-silver smelting ore and a 6-ton lot of gold-silver concentrates were shipped.

Pioneer district (*Rico*).—The Rico district in 1930 produced 7,650 tons of ore yielding, in terms of recovered metals, $7,975 in gold, 80,683 ounces of silver, 309,000 pounds of copper, 1,355,000 pounds of lead, and 1,190,000 pounds of zinc. Classification of ore shipped in 1930 was as follows: Silver ore, 128 tons; copper-silver-gold ore, 1,692 tons; lead-silver-gold ore, 688 tons; and zinc-lead-copper-silver-gold ore, 5,142 tons. The last-mentioned type of ore was shipped to Utah to the custom flotation mills of the Combined Metals Reduction Co. at Bauer, the International Smelting Co. sulphide concentrator at Tooele, and the United States Smelting, Refining & Mining Co. at Midvale. All the rest of the ore was direct smelting ore. The two largest producing mines were the Rico Argentine and the Wellington group of the St. Louis Smelting & Refining Co. Other producers were the A. B. C. group, Atlantic Cable, Buckhorn Tunnel group, Etta Grace, Falcon, Hicks, Lucky Boy, Pro Patria, and Union Carbonate. The St. Louis Smelting & Refining Co. began driving what will be a new 5,000 to 6,000 foot adit to cut the company's workings at lower depth.

EAGLE COUNTY

Battle Mountain district (*Red Cliff, Gilman*).—Eagle County became one of the principal producing counties in 1930 through the production of the Empire Zinc Co. Eagle mine on Battle Mountain near Red Cliff. Since 1912 this company has been opening and developing its holdings, with some regular annual production; throughout 1930 it ran the 600-ton jig and flotation mill completed and set in operation in November, 1929. The mill is built in an excavation cut into the granite face of Eagle Canyon; therefore, most of it is underground. In addition to milling the zinc-lead ore the company continued to ship copper-iron-silver-gold and iron-silver-gold ore to Utah smelters. The zinc concentrates from the mill were sent to Depue, Ill., and the lead concentrates to the Leadville smelter.

Holy Cross district.—Sluice boxes placed on the Golden Gate claim treated old mill tailings from the Golden Pelican and recovered 450 pounds of gold concentrates containing 4.7 ounces of gold. A small batch of amalgam bullion, also recovered in the sluice boxes, was sold for $17.

Fulford district.—A 942-pound lot of ore shipped from the Fulford district assayed 0.57 ounce of gold to the ton.

EL PASO COUNTY

The Golden Cycle mill at Colorado Springs, El Paso County, treats all the gold telluride ores, containing 0.1125 ounce gold and above, from the Cripple Creek district, Teller County. When built in 1907 the mill was a 1,200-ton roast-amalgamation-cyanidation mill. Since 1927 a supplementary installation of crushers, a ball mill, and a Dorr classifier has been used to treat in an all-sliming cyanidation circuit, without preliminary roasting, gold pyrite ores and concentrates from Leadville, Empire, Idaho Springs, and Russell

Gulch; siliceous gold ore from the London mine west of Alma Junction, Park County; siliceous silver ores from Creede; and high-grade specimen gold ore from Summitville. In 1929 crushers, ball mills, and Fahrenwald flotation machines were installed to treat any ores offered, including zincky ores. This addition to the plant began operating in November, 1929, and zincky ores were purchased up to November, 1930.

FREMONT COUNTY

No mine in Fremont County was productive in 1930.

Canon City smelter.—The Empire Zinc Co. zinc oxide plant at Canon City continued operation throughout 1930 on zinc concentrates from the company's flotation mill at Hanover, N. Mex.

GARFIELD COUNTY

Newcastle district.—Assessment work was done in 1930 on the Gray Eagle property near Newcastle.

Rifle Creek district (Rifle).—The 140-ton salt-roast, leach, and precipitation plant of the United States Vanadium Corporation (subsidiary of the Union Carbide & Carbon Co.) at Rifle on the Denver & Rio Grande Western Railroad was operated steadily in 1930.

GILPIN COUNTY

In 1930 Gilpin County lode mines produced 132,346 tons of ore yielding $136,941 in gold, 21,670 ounces of silver, 90,300 pounds of copper, 94,300 pounds of lead, and 7,000 pounds of zinc, with a total gross calculated value of $162,074, compared with $151,126 in 1929, $81,886 in 1928, and $39,696 in 1927. Of the total tonnage treated in 1930, 131,967 tons were classified as dry gold ore. Placer mines in the Rollinsville and Black Hawk districts yielded 133.95 fine ounces of gold and 26 ounces of silver. Fineness of the Black Hawk bullion when melted at the Denver Mint ranged from 0.752 to 0.813 in gold and from 0.148 to 0.164 in silver, and fineness of the Rollinsville bullion ranged from 0.836 to 0.877 in gold and from 0.118 to 0.141 in silver.

Southern districts (Black Hawk, Central City, Nevadaville, Russell Gulch).—The principal producer in the southern districts was the Chain O'Mines (Inc.), which operated "The Patch," Roderick Dhu, and San Juan properties at Nevadaville by shrinkage stoping and glory-hole mining, transporting the low-grade gold ore (with accompanying copper, lead, and zinc minerals) from the mouth of the La Cross Tunnel (adit) by trucks and by a 3,000-foot aerial tram to the amalgamation-gravity concentration-selective flotation-cyanidation mill, built just above the Colorado & Southern Railway station at Central City. The Chain O'Mines (Inc.) mill, built in 1929–30, was operated 324 days in 1930 at an average daily rate of 400 tons. The equipment of the mill is as follows: 1 Universal 11 by 18 inch crusher, 1 Farrel 12 by 24 inch crusher, 1 Farrel 12 by 36 inch crusher, 1 Symons 2-foot pulverizer, 1 Symons 4-foot pulverizer, 1 Ruth 4½-inch by 11-foot rod mill, 1 Allis-Chalmers 5 by 18 foot tube mill, 1 Colorado Iron Works 6½ by 10 foot ball mill, 1 Allis-Chalmers 6 by 7 foot ball mill, 2 Akins 5-foot drag classifiers, 1 Dorr classifier, 22 Deister and Wilfley tables, 2 Ruth 31-inch 12-cell flotation machines, 2 Ruth 21-inch 12-cell flotation machines, and 1 American 6-foot 4-

leaf filter. Of the other 20 producing properties in the southern districts the most important were the Big Six, Champion, Cousin Jack, Egyptian, Gold Cup, Hartford, Jennie Blanche, Marquette, McCallister, Meeker-Success, Perrin, Pittsburg, and Saratoga.

Northern districts.—The lode mines in the northern districts in 1930 produced 407 tons of ore yielding $2,334 in gold, 1,000 ounces of silver, and 24,000 pounds of copper, with a total gross calculated value of $5,839. A lessee on the Gold Dirt dump with a small homemade amalgamation-concentration mill produced amalgam gold-silver bullion containing 44.98 ounces of gold and 4 ounces of silver and 14 tons of gold concentrates containing 21.62 ounces of gold. Ore from a new location called the "We Got Em" lode and from a lease on the Reform lode and mill site was treated in a small amalgamation-concentration mill to produce amalgam gold-silver bullion and gold concentrates. In the 5-stamp (light-weight) mill equipped with 1 plate, 1 screen, and 1 McFarlane concentrating table with a full capacity of 6 tons daily, a small quantity of gold ore was treated for a short time at the rate of 2 tons a day. The ore came from the Providence-Newport group and yielded amalgam gold-silver bullion and gold concentrates. Clean-up operations at the Evergreen mine resulted in the shipment of 62 tons of copper matte containing also silver and gold. The matte was produced several years ago in an experimental electric smelter. Producing placers were the Fontleroy and Victoria near Rollinsville, both operated by sluicing.

GRAND COUNTY

No production of metals was made in Grand County in 1930. Prospects in Grand County were reviewed briefly in the 1929 report of this series.

GUNNISON COUNTY

Domingo (*Goose Creek, White Earth*) *district* (*Madera, Powderhorn, Spencer, Vulcan*).—In 1930 the Vulcan Consolidated Mines Corporation, lessee of the Good Hope-Vulcan group, shipped 99 tons of ore yielding 6.4 ounces of gold and 13.7 ounces of silver to the ton.

Gold Brick district (*Ohio*).—A lessee on the Gold Links mine shipped 24 tons of gold-silver ore to the Golden Cycle mill in 1930, and Winslow & Williams shipped 20 tons of gold-silver ore to the Golden Cycle mill and 20 tons of lead-silver-gold ore to the Leadville smelter.

Quartz Creek district (*Pitkin*).—The Roosevelt adit was driven 648 feet in 1930, making it about 6,000 feet long.

Rock Creek district (*Marble*).—The Skyline Mining Syndicate shipped 17 tons of lead-silver-[zinc] ore from the Eagle-Lead Bullet in section 6, T. 12 S., R. 87 W.

Tomichi district (*White Pine*).—Ore shipped from the White Pine district in 1930 totaled 108 tons, 28 tons being lead-silver ore and 80 tons zinc-lead ore.

HINSDALE COUNTY

Galena district (*Lake City*).—The Empire Chief 200-ton gravity concentration-flotation mill, built in 1929, was operated intermittently at the rate of 47 tons daily in July and August, 1930, on a zinc-lead-copper-silver-gold sulphide ore from the Empire Chief; the concentrates produced (200 tons) were not shipped, being stored at the mill. The Empire Chief is opened by one adit 680 feet long and one adit 2,514 feet long, of which 447 feet were driven in 1930. The mine was operated continuously from January 1 to September 1, 1930. The equipment of the mill was described in the 1929 report of this series. The lessee on the Highland Chief group of the Empire Chief Co. continued development work during the year and sent several hundred tons of ore through the Empire Chief mill. The Townsend Lead-Zinc Co. in 1930 widened the Chicago adit and installed track and air lines. The adit is 1,105 feet long and will be used to develop the company's claims, which include the Pearl and Ruby group and others. The Ute and Ulay 150-ton flotation mill, built in 1929–30 and described in the 1929 report of this series, was not operated in 1930.

LAKE COUNTY

In 1930 Lake County produced 131,202 short tons of ore yielding, in terms of recovered metals, gold, silver, copper, lead, and zinc having a total gross calculated value of $2,161,628, compared with 125,014 tons of ore and $2,826,261 in 1929 and 121,415 tons of ore and $2,903,122 in 1928. Lake County also produced 414,449 short tons of molybdenum ore from which 2,910 tons of molybdenum sulphide concentrates containing 3,083,000 pounds of elemental molybdenum were made, and shipped 19,730 long tons of ferruginous manganese ore to steel mills.

LEADVILLE DISTRICT [4]

GENERAL FEATURES

In 1930 the metal production of Lake County, except molybdenum and 163 tons of ore from the Continental Chief mine and 2 tons of ore from Wortman, came from the Leadville district.

Classification of Leadville ores in 1930, in terms of original content

	Ore		Original analysis							
	Per cent	Short tons	Gold	Silver	Copper (wet assay)	Lead (wet assay)	Zinc	Silica	Iron	Sulphur
			Ounces per ton	*Ounces per ton*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Sulphide:										
Siliceous (carrying sulphides)	...	685	1.022	7.32	0.18	0.12	0.08	(?)	(?)	(?)
Iron pyrites	3	3,852	.076	56.59	------	3.16	1.20	3.8	41.0	47.3
Lead (silica excess)	...	20	.510	7.80	------	7.01	10.50	24.3	19.4	17.0
Lead (iron excess)	------	329	.107	6.08	.36	9.54	9.73	22.0	23.5	26.7
Zinc-iron-lead (smelting)	9	12,160	.030	4.00	.31	9.64	21.81	(?)	(?)	(?)
Zinc-iron-lead (milling—original leads)	63	81,767	.004	4.60	------	7.70	17.80	6.0	26.5	(?)
Dry	1	1,028	.163	3.39	.26	4.43	9.99	(?)	(?)	(?)
	76	99,841	------	------	------	------	------	------	------	------
Oxide (including low-sulphur ores):										
Siliceous gold	1	848	1.787	9.89	1.01	2.38	2.12	40.3	25.0	6.0
Siliceous silver (including old slags)	21	26,958		3.07	.09	3.00	4.78	30.5	27.8	1.5
Lead (silica excess)	2	2,672	.167	4.70	.00	13.21	1.10	39.0	23.3	1.1
Lead (iron excess)	------	718	.076	5.13	------	15.39	3.14	22.2	29.4	1.7
	24	31,196	------	------	------	------	------	------	------	------
	100	131,037	------	------	------	------	------	------	------	------

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[4] For geology, history, and production see Emmons, S. F., Irving, J. D., and Loughlin, G. F., Geology and Ore Deposits of the Leadville Mining District, Colo.: U. S. Geol. Survey Prof. Paper 148, 1927, 368 pp.

Only one of the three furnaces of the A. V. lead bullion-leady copper matte smelter of the American Smelting & Refining Co. was operated in 1930. All the ores and concentrates treated in 1930 came from Colorado mines. As has been the situation for several years, this plant has had to depend partly on slag from old smelter dumps carrying a little silver and lead. The quantity of such slag used in 1930—26,958 tons—came from the American, Bi-Metallic, and Union old smelter dumps.

The Leadville Zinc-Lead Co. 310-ton selective flotation mill was operated for 335 days at a daily average of 244 tons. The plant ceased production on December 31, 1930, the final clean-up being made on January 4, 1931. The mill handled chiefly zinc-lead-iron-silver-copper-gold sulphide ore from the Leadville Deep Mines Co. in 1930; but it also accepted similar ore from the Resurrection, Silver Spoon, and Yak mines. No additions were made to the equipment of the mill, which was described in the 1929 report of this series. Zinc concentrates in 1930 averaged 50.4 per cent of zinc, 3.1 per cent of lead (wet assay), and 3.9 ounces of silver and 0.005 ounce of gold to the ton. Lead concentrates averaged 12.5 per cent of zinc, 49.3 per cent of lead (wet assay), and 21.3 ounces of silver and 0.02 ounce of gold to the ton. The zinc concentrates were shipped to the United States Zinc Co. zinc retort plant at Amarillo, Tex. The lead concentrates went to the A. V. smelter.

As usual some of the ores mined at Leadville were shipped for treatment elsewhere. Specimen gold went to the Denver Mint; pyritic gold ores were shipped to the nonroast cyanidation department of the Golden Cycle mill at Colorado Springs, and zinc-lead-silver sulphide ores to the pigment plant at Coffeyville, Kans.

MINES REVIEW

The Leadville Deep Mines Co. continued to extract ore and develop a consolidated group of mines on Carbonate Hill and in Graham Park. The company's property yielded the bulk of the zinc-lead-silver-gold-iron sulphide and silver-gold-copper-lead-iron (called dry silver ore) sulphide ore from the district in 1930. Production in 1930 came from the Alleghany, Brookland, Clontarf, Gonabrod, Greenback, Mahala, Marian, Mikado, Monte Christo, Moyamensing, R. A. M., Robert Emmet, and Wolftone claims. Pumping, hoisting, and other operations are centered at two vertical shafts 1,357 and 1,390 feet deep. The details of the unwatering of this area are described in the reports of this series for 1925 and 1926. In 1930 development work totaled 7,359 feet of drifts and 1,395 feet of raises. Besides supplying ore to the Leadville Zinc-Lead Co. mill and silver-gold-copper-lead-iron-[zinc] sulphide ore to the A. V. smelter the Leadville Deep Mines Co. shipped some zinc-lead-[silver-gold] ore to the leaded-zinc oxide plant of the Ozark Smelting & Mining Co. at Coffeyville, Kans. Similar ore was shipped to Coffeyville from the Henriett-Maid of Erin mine and from the Yak mines.

In addition to the producing mines mentioned, other producers at Leadville were the Adelaide, Dolly B, Famous, Golden Eagle, Ibex, Luema, New Monarch, Rubie, St. Louis Tunnel, and Venir. Ferruginous manganese ore was shipped to the steel mill at Pueblo from the Star group (Morning Star and Evening Star) and from the Stevens mine.

OTHER DISTRICTS

Alicante, Colorado Gulch, Lackawanna Gulch, Red Mountain, St. Kevin, and Sugar Loaf districts (north and west of Leadville).—A 2-ton lot of gold ore was shipped from the Alicante district in 1930.

Mosquito Range district.—In 1930 reopening of the Continental Chief mine [5] resulted in the shipment of 163 tons of lead-silver ore.

Tenmile (Climax, Fremont Pass) district.—In 1930 the Climax Molybdenum Co. mill at Climax on Fremont Pass treated 414,449 tons of molybdenum ore yielding 2,910 tons of molybdenum sulphide concentrates containing 3,083,000 pounds of elemental molybdenum. Mining is by the shrinkage-stope system and caving.[6] The company continued its new Phillipson Tunnel (465 feet below the present working level) through the Mosquito fault and into the mineralized area. The company also completed a new crushing plant with a capacity of 300 tons an hour. The equipment of the mill was described in the 1929 report of this series.

Molybdenum production at the Climax mill in Colorado, 1924–1930

	Elemental molybdenum (pounds)
1924 (5 months operation; idle 7 months)	156, 935
1925	821, 757
1926	1, 057, 367
1927	1, 858, 228
1928	2, 957, 845
1929	3, 529, 295
1930	3, 083, 000
	13, 464, 427

LA PLATA COUNTY

Within the boundaries of La Plata County are the California (La Plata), Cave Basin, Needle Mountain, and Oro Fino mining districts. At Durango is the American Smelting & Refining Co. lead bullion and leady copper matte smelter, equipped with one blast furnace. It handles mainly concentrates but also whatever ore is offered from Dolores, La Plata, Ouray, San Juan, and San Miguel Counties, with occasional lots of ore from Mineral, Lake, and Eagle Counties. The smelter also owns the sulphating plant originally built there by the Complex Ores Recoveries Co. (or Read-Coolbaugh) in 1923 to remove the zinc from the Black Bear (Upper San Miguel district, San Miguel County) bulk concentrates; after the Black Bear operations ceased the American Smelting & Refining Co. acquired the sulphating plant and adjusted it to remove the zinc from other zinc-bearing material, particularly zinc-lead middlings from the Sunnyside mine at Eureka. The zinc sulphate produced has been sold in recent years as a sulphating reagent. The smelter and sulphating plant were closed on November 30, 1930.

California (or La Plata) district (Hesperus, La Plata).—Twelve mines in the California district produced 272 tons of ore containing

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[5] Behre, C. H., jr., Revision of Structure and Stratigraphy in the Mosquito Range and the Leadville District, Colo.: Colorado Sci. Soc. Proc., vol. 12, 1929, pp. 48, 50–55.

[6] Coulter, W. J., Mining Molybdenum Ore at Climax, Colo.: Eng. and Min. Jour., vol. 127, No. 10, Mar. 9, 1929, pp. 394–400. Crushing and Concentrating Molybdenum Ore at Climax, Colo.: Eng. and Min. Jour., vol. 127, No. 12, Mar. 23, 1929, pp. 476–480.

Butler, B. S., and Vanderwilt, J. W., The Climax Molybdenum Deposit of Colorado: Colorado Sci. Soc. Proc., vol. 12, 1931, pp. 309–353; with Section on History, Production, Metallurgy, and Development, by Chas. W. Henderson.

410.32 ounces of gold and 2,969 ounces of silver. Only 160 tons of ore in 1930, compared with 19,863 tons in 1929, were treated at the La Plata Mines Co. mill from the Gold King group. Development work at this mine in 1930 consisted of 200 feet of winzes, 412 feet of drifts, and 75 feet of raises. The equipment of the mill was described in the 1929 report of this series. Other producing mines were the Bessie G, Comstock, Curtet, Idaho, Little La Plata, May Day, Mountain Lily, Nonpariel, Oliver Twist, Sadie, and Timberline.

MESA COUNTY

Sinbad district.—At the Precipice prospect 65 miles southwest of Whitewater development work was continued during 1930, and a 1,300-foot tramway was built.

MINERAL COUNTY

Creede district.—Five mines in the Creede district in 1930 shipped 4,576 tons of ore containing 123.53 ounces of gold, 434,812 ounces of silver, 165,096 pounds of lead, and 26,724 pounds of zinc. Producing mines were as follows: Amethyst, Commodore, Happy Thought, New York-Last Chance-Del Monte, and Pittsburg. The lessee on the Amethyst drove 190 feet of drifts and 80 feet of crosscuts and sank 100 feet of winzes. The lessee on the Commodore drove 150 feet of drifts, 90 feet of raises, and 150 feet of crosscuts. The lessee on the Happy Thought drove 100 feet of raises and 100 feet of drifts; the Happy Thought is part of the Creede Mines (Inc.), which is opened by a 12,000-foot adit connecting with a 1,600-foot shaft. The lessee on the New York-Last Chance-Del Monte group drove 180 feet of drifts. All these mines were closed on June 1 on account of the low price of silver.

MOFFAT COUNTY

Douglas Mountain district.—A lessee on the Garfield-Bromide group, in sections 9 and 16, T. 7 N., R. 101 W., shipped 25 tons of copper-silver oxidized ore to the Midvale lead plant in Utah. The ore was trucked 106 miles north to the Union Pacific Railroad at Rock Springs, Wyo. The mine is opened by a 250-foot vertical shaft and 1,375 feet of drifts on three levels.

Timberlake Gulch district.—No placer gold was produced in the Timberlake Gulch district in 1930. James Gooldy was occupied in installing a drag line on his property in section 2, T. 10 N., R. 92 W. William McLaughlin, in sections 23 and 26, T. 12 N., R. 91 W., operated a rocker for a few days and recovered $5 or $6 in gold, which was not marketed in 1930. The Gold Production Corporation built a small dredge on the Timberlake property of James Gooldy, but it burned down without operating.

MONTROSE COUNTY

The general-merchandise store at Naturita in 1930 shipped a small bar of placer gold bullion taken in exchange for groceries. The bullion when melted at the Salt Lake City assay office averaged 0.756 fineness in gold and 0.236 fineness in silver; it was recovered from small placer operations on the San Miguel River.

OURAY COUNTY

Red Mountain district.—Production from four mines in the Red Mountain district in 1930 totaled 1,690 tons of ore yielding, in terms of recovered metals, 38.99 ounces of gold, 8,096 ounces of silver, 10,000 pounds of copper, and 54,000 pounds of lead, with a total gross calculated value of $7,923. Lessees on the Beaver-Belfast cleaned out cave-ins, retimbered the 520-foot adit, and stoped 70 tons of zinc-lead-copper-silver ore, which was treated at the selective flotation mill in the old Treasury Mountain mill building. Concentrates produced were shipped to Midvale, Utah. A car of copper-silver ore was shipped from the Guadalupe to Tooele, Utah. A lessee on the Mickey Breen mine hauled to the Sutton mill near Ouray 80 tons of ore from which 12 tons of lead-silver-gold concentrates were made. From the Yankee dumps about 1,500 tons of ore were milled at the flotation plant installed in the old Treasury Mountain mill building.

Sneffels district.—The King Lease continued operation on the upper workings of the famous Camp Bird mine and operated both the mine and mill 365 days. The equipment of the King Lease mill was given in the 1929 report of this series. The amalgam bullion in 1930 assayed 0.734 fineness in gold and 0.237 fineness in silver. The table concentrates made in 1930 were classified as lead-gold-silver, with the principal value in gold, but they also carried some copper and zinc. A brief history of the operations of the Camp Bird mine was given in the 1929 report of this series. A lessee on the Trust-Ruby shipped 18 tons of dry gold ore to the Golden Cycle mill.

Uncompahgre district (Ouray).—The only production from the Uncompahgre district was clean-up of the Mutual Gold Mines Co. mill below Ouray. The bullion resulting from this clean-up was sold to the Denver Mint. The gold averaged 0.881 in fineness and the silver 0.103.

PARK COUNTY

Park County in 1930 produced gold, silver, copper, and lead valued, in terms of recovered metals, at $474,143, of which $452,142 was in gold. Lode mines produced 5,134 tons of ore containing 22,319.00 ounces of gold, 12,356 ounces of silver, 13,813 pounds of copper, 400,630 pounds of lead, and 276,808 pounds of zinc. A placer mine produced 6.10 crude ounces which when melted at the Denver Mint weighed 5.89 ounces, with a fineness in gold of 0.827 and in silver of 0.163.

Beaver Creek district (Fairplay).—Lessees on the Shelton placer were occupied from May 15 to September 21 in developing hitherto unworked parts of the 380 acres included in this group. No production resulted in 1930.

Buckskin district (Alma).—A 4-ton lot of gold-silver ore was shipped to the Golden Cycle mill from the Loveland Mountain group, and a 33-ton lot of gold-silver ore was shipped to the Golden Cycle mill from the Gold Bug mill site. At the Sweet Home mine 125 feet of new winze were sunk below the level of the long adit which opens the property. Development work was done during the summer of 1930 by the Alma Gold Corporation, which controls the Great West, No End, Little Fannie, and other groups.

Consolidated Montgomery district (Alma).—From the Pacific mine dump two cars of gold ore were shipped to the Golden Cycle mill and a small lot of gold-silver ore was shipped to the Leadville smelter. At the Juanita-May group 50 feet of development work were done in 1930, making the total development 280 feet of drifts and a 100-foot shaft. A little development work was done on the Rhinegold-Sarsfield group. The Russia mine was idle. The Alma Syndicate (Inc.) prospected the Weber group by diamond drilling east of the earlier development work and found in the "Blue" lime good indications of lead-silver ore. An 85-foot vertical shaft disclosed lead-silver mineralization.

Fairplay district.—Development work was done on the Snowstorm placers, formerly operated by hydraulicking.

Freshwater district (*Guffey*).—From the 73-foot incline shaft on the Susannah 153 feet of drifts were run in 1930, and a 1½-ton test lot was shipped. This lot was found to have a low gold content.

Hall Valley district (*Webster*).—A 1-ton lot of gold-silver ore was shipped from the Freund prospect. At the La Clede-Missouri group 9½ miles northeast of Webster 200 feet of drifts and raises were driven in 1930. The property is opened by an adit 500 feet long. It has been an intermittent producer of copper-lead-[zinc]-silver-gold ore. In 1927 and in previous years ore from the La Clede-Missouri contained bismuth, which at times was made a part of the credit computation on the settlement.

Horseshoe district.—No work or production was reported in 1930 from the Horseshoe district, once a producer of zinc and lead-silver ores.

Mosquito district (*Alma*).—During 1930 the London Gold Mines Co., operator of the London Extension group (owned jointly by the London Extension Mining Co. and the London Mining & Milling Co.) and of the London group (owned exclusively by the London Mining & Milling Co.), drove 5,711 feet of drifts and raises on the London group and extracted from the Mother, Paris, Easton, and Allentown claims 3,759 tons of dry gold ore containing 5.01 ounces of gold to the ton and a little silver, lead, copper, and zinc. The company also did 514 feet of development work on the London Extension group and extracted from that group 999 tons of dry gold ore containing 3.76 ounces of gold to the ton, shipping it to the Leadville smelter and to the Golden Cycle mill. The Alma Mining & Milling Co., lessee on that part of the London and Paris claims above the North London Tunnel and after November 1, 1929, above the South London Tunnel, ran for a time its North London flotation mill at the mouth of the Blanchard Tunnel adit, sometimes called the North London Tunnel, and shipped one lot of lead-gold-silver concentrates. The London Gold Mines Co. operated both groups through the London Extension Tunnel adit, which is about 4,500 feet long. Lessees on the Orphan Boy shipped several narrow-gage cars of gold-silver ore to the Golden Cycle mill. At the Champaign, opened by two adits, 1,450 and 1,000 feet long, respectively, 200 feet of retimbering and 150 feet of drifting and sinking were done in 1930. At the Hock Hocking, opened by a 2,500-foot adit, 200 feet of drifts and 98 feet of raises were driven in 1930. At the Pirate 90 feet of development work were done in 1930, making a total development on the property of 200 feet in three adits.

Tarryall district.—The Ute Gold Mining Co., lessee, which in 1928–9 did considerable development work on the Look property, did no work there in 1930. The lease has two years to run.

PITKIN COUNTY

The total gross calculated value of the output of gold, silver, and lead, in terms of recovered metals, in Pitkin County in 1930 was $65,074, compared with gold, silver, lead, and zinc valued at $155,609 in 1929. Except for 600 tons of silver ore treated at the Midnight mill the ore was shipped to smelters and was classified as follows: Lead-silver ore, 1,680 tons; dry silver ore carrying some lead, 5,223 tons.

Avalanche Creek district (*Carbondale*).—A 3-ton lot of lead-silver ore was shipped from the Question Mark (Nos. 1 and 2) prospect to the Leadville smelter; the property is opened by a 110-foot adit. Several test lots of lead-silver ore were shipped from the Double Decker-Groundhog-Gypsum group.

Lincoln Gulch district (*Aspen*).—The Lincoln Gulch Metal Mines Co., operating the Martin mines, drove 30 feet of adit and did some trench work on the surface in 1930; the company in 1930 reports total development as two 500-foot adits. No work was done in 1930 at the Ruby or at the Sailor Boy.

Roaring Fork district (*Aspen*).—The bulk of the production from Pitkin County came from the mines at Aspen. The Smuggler Leasing Co. drove 1,000 feet of drifts and 90 feet of raises. Company operation was for 205 days and operations by lessees for 310 days. Production in 1930 came from the Smuggler, Durant, and Late Acquisition. The Continental Divide Development Co., lessee of Cowenhoven adit and the Della S group, shipped 581 tons of lead-silver oxide ore carrying 0.006 ounce of gold and 14.8 ounces of silver to the ton, 8.38 per cent of lead, 37.0 per cent of silica, 6.5 per cent of iron, 4.3 per cent of zinc, and 3.9 per cent of sulphur. Another lessee shipped from the Della S two cars of ore carrying 64.2 ounces of silver to the ton, 5.72 per cent of lead, 57.2 per cent of silica, 2.7 per cent of iron, 8.0 per cent of zinc, and 14.5 per cent of sulphur. The bulk of the shipments by the Smuggler Leasing Co. averaged 753 ounces of silver to the ton, 4.3 per cent of lead, 8.4 per cent of silica, 2.1 per cent of iron, 1 per cent of zinc, and 0.3 per cent of sulphur. Very similar limy ore was shipped from the Aspen Fraction, Durgen, and Spar.

In the latter part of 1930 the Midnight Mining Co. completed a 50-ton flotation mill which is equipped as follows: 1 Universal crusher, 1 Ruth 3 by 9 foot rod mill, 1 locally made classifier, 1 Wilfley table, 1 Ruth 8-cell flotation machine, 1 drier (pipe coils), and a 128-foot conveyor. The mill was operated during December; and ore carrying 11 ounces of silver to the ton, 3 per cent of lead, 6 per cent of zinc, 5 per cent of iron, 60 per cent of insoluble, and 8 per cent of lime yielded concentrates containing 140 ounces of silver to the ton, 54 per cent of lead, 8 per cent of zinc, 2.7 per cent of iron, 16.6 per cent of insoluble, and 9.8 per cent of lime. The Midnight Mining Co. also shipped some smelting ore containing 68.7 ounces of silver to the ton, 4.7 per cent of lead, 69 per cent of silica, 4.2 per cent of iron, 6.8 per cent of sulphur, and 3.6 per cent of zinc and a car of smelting ore containing 33.3 ounces of silver to the ton, 7 per cent of lead, and 10.8 per cent of zinc. All the assays given for lead are wet assays. The Midnight property is opened by an adit 6,700 feet long, 1,000 feet of drifts, and a 500-foot vertical shaft.

RIO GRANDE COUNTY

South Mountain district.—The Marian Mining & Milling Co. 50-ton flotation mill was operated one week in 1930 for a special test. The concentrates produced at a high ratio of concentration were lead-copper-[zinc]-silver-gold concentrates containing a relatively high content per ton of gold, silver, and lead. The Miser-Guadalupe group operated by this company is developed by a 100-foot vertical shaft, a 1,500-foot adit, and 150 feet of drifts. In 1930 development consisted of sinking a winze for 70 feet, drifting on the 100-foot level for 140 feet, and driving a few raises.

Summitville district.—The lessee on the Little Annie mine at Summitville was engaged in cleaning and opening old workings in 1930 and shipped 19 tons of ore containing 345.97 ounces of gold and 58 pounds of ore containing 45.40 ounces of gold. The mine, an important producer in the seventies and an occasional producer after 1880, was reopened in 1926 by the present lessee, who had known for 20 years of an extraordinary outcrop of gold which lay in an unworked part of the property. In 1926, 21 tons of quartz containing free gold yielded 5,118.02 fine ounces of gold. In 1927, 137 tons of ore returned $117,826.49 in cash after hauling, freight, and treatment costs were deducted. In 1928 returns were $212,942.62 after freight and treatment were deducted. In 1929, 140 tons of ore contained 909.38 ounces of gold and 194 ounces of silver.

ROUTT COUNTY

Clark district.—At the Fall River-Slavonia the dam and the mine buildings were repaired, but no underground work was done. Assessment work for completion of patent was done in 1930 at the Greenville-Mountain Ram group; it is opened by a 100-foot vertical shaft.

Copper Spur district.—No development work was done at the Copper King property by the Cole Mining & Milling Co. in 1930.

Hahns Peak district.—The Hahns Peak Gold Mining & Milling Co. in 1930 retimbered the main adit and repaired the buildings at the Royal Flush mine; also, the company drove 75 feet of drifts and 40 feet of raises. There are 3½ miles of adits, drifts, and crosscuts on the property. At the Master Key property the shaft was deepened 150 feet, and 630 feet of drifts were driven; the total development on the property to the end of 1930 was a 320-foot vertical shaft, 630 feet of drifts, and a 130-foot adit.

SAGUACHE COUNTY

The total gross calculated value of metals estimated as recovered from ore mined in Saguache County in 1930 was $417,426, compared with $1,241,209 in 1929.

Crestone district.—J. A. Keys, lessee on the Independence property, in April, 1930, completed a 40-ton concentration mill on Cottonwood Creek on Baca Grant No. 4, 5½ miles south of Crestone, and made three test runs of the mill in May, June, and August. The concentrates produced at a high ratio of concentration were excellent in gold and silver content; but the over-all results were not considered satisfactory, and no further development was done in the mine. Apparently some of the ore concentrated came from the Sunset claim.

Assessment work was done on the Extension, 55 feet of adit were driven on the Osage, 30 feet of drifting were done on the Pelican, and and 100 feet of development were done on the Reed-Myers.

Kerber Creek district (Bonanza).—The Rawley Mines (Inc.) 350-ton flotation mill on Squirrel Gulch, a tributary of Kerber Creek, near Bonanza and 18 miles from Villa Grove, was operated steadily at a daily average of 320 tons until June 26, when the mill was closed, due to exhaustion of ore which would pay to mine and mill, and sold for its salvage value. Development work in 1930 consisted of 1,746 feet of drifts and raises. A history of the operations of the Rawley Mines (Inc.) and a description of the equipment of the mill were given in the 1929 report of this series. No other property in the district produced in 1930.

Orient district (Villa Grove, Mineral Hot Springs).—On the eastern side of the San Luis Valley east of Villa Grove and Mineral Hot Springs is the Colorado Fuel & Iron Co. Orient iron mine, from which iron oxide ore goes to the company's iron and steel mill at Pueblo.

SAN JUAN COUNTY

Animas district (Silverton).—In the Animas district producing mines in 1930 were the Garry Owen-Old Hundred, Little Fannie-Philadelphia, Mayflower, Melville-Tiger, Ohio, Old Abe, Pride of the West, Royal Charter-Little Nation, Silver Lake, and Topaz.

The Shenandoah-Dives mill on the Animas River 3 miles northeast of Silverton, almost completed at the end of 1929, was put in operation in February, 1930. The equipment is as follows: 1 No. 16A Telsmith crusher, 1 Symons cone 4-foot crusher, 1 Marcy trommel, 1 Traylor vibrating F-B2 single-deck screen, 1 Marcy 8 by 6 foot ball mill, 1 Stearns Roger 10 by 4 foot ball mill, 1 Dorr 12 by 26¾ foot classifier, 1 Dorr 15-foot bowl classifier, 6 No. 6 Wilfley tables, 2 Minerals Separation 20-cell 21-inch flotation machines, 1 Minerals Separation 10-cell 12-inch flotation machine, 1 Dorr 4 by 10 foot filter, 2 Dorr 35 by 10 foot thickening tanks, and 1 Dorr 50-foot-diameter thickening tank. The mill was operated at a daily average of 357 tons from the Slide claim and from the Mayflower claim[7] which is connected with the mill by a 2-mile aerial tram. Development in 1930 consisted of 31 feet of crosscuts, 3,246 feet of drifts, and 391 feet of raises. Both coarse and fine crushing are done in the mine crushing plant. The finely crushed material is transported over the tramway to the mill, where it is ground in ball mills and concentrated over Wilfley tables; and the remainder is reground through ball mills, floated in flotation cells, thickened in settling tanks, and filtered. The ratio of concentration was 17.5:1; the concentrates were gold-silver-copper-lead-[zinc].

The Colorado Mexico Mining Co., operating the Melville-Tiger group under bond and lease, operated the mine and mill steadily except for short periods when the work was held up owing to damage from snowslides. The Iowa mill equipment as remodeled by the Shenandoah-Dives Syndicate in 1928 was described in the 1929 report of this series; the Colorado Mexico Mining Co. reports the equipment as of February 27, 1931, as follows: 1 Blake 11 by 15 inch crusher, 1 Stearns Roger 6 by 5 foot ball mill, 1 Dorr Model-D 3½ by 18⅓ foot classifier, 6 Wilfley tables, 1 Minerals Separation 14-cell 18-inch flotation machine, 1 Dorr 4 by 4 foot filter, 1 homemade dryer, and 1 Dorr 8 by 16 foot thickening tank. The mill is situated in Arrastra Gulch and is connected with the mine by a 10,000-foot aerial tram. Concentrates produced in 1930 were gold-silver-lead-copper-[zinc]. In 1930 development consisted of 412 feet of drifting on the Melville vein and 300 feet of raises. Total development at the mine is described as a 500-foot underground shaft, an 80-foot crosscut to the Melville vein, and 8,000 feet of drifts on the Melville vein.

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[7] For a history of the Shenandoah-Dives Syndicate see Chase, C. A., A Geological Gamble in Colorado Meets with Success: Eng. and Min. Jour., vol. 128, Aug. 10, 1929, pp. 203-205.

The Dresser Mining Co. operated the "Garry Owen" tunnel for three months and the "Old Hundred" mill (built in 1905–6) for two months during 1930. The equipment of the "Old Hundred" mill is as follows: 1 McFarlane-Eggers crusher, 20 stamps (not used), 1 Marcy mill, 1 Model-C Dorr classifier, 5 No. 6 Wilfley tables, 2 Minerals Separation 8-cell flotation machines, 2 Oliver 8 by 8 foot filters, and 2 Dorr 20 by 14 foot thickening tanks. The development work in 1930 totaled 400 feet. The ore extracted came from the Sterling and Richmond groups. The concentrates produced were [zinc]-lead-copper-silver-gold.

The Altamont Mining Co. ran the Pride of the West mill for a short time in 1930. The equipment of the mill is as follows: 1 Blake crusher, one 3 by 8 foot trommel, 1 Allis-Chalmers ball mill, 1 Dorr classifier, 3 Wilfley tables, 1 Fahrenwald 8-cell flotation machine, 1 Oliver filter, and 1 Dorr thickening tank. Concentrates produced in 1930 were gold-silver-copper-lead-[zinc].

The Vertex Mining Co., a subsidiary of the Tonopah Mining Co., which completed a new 100-ton flotation mill and a 7,000-foot aerial tram in December, 1929, operated the mill from January 1 to November 15, 1930, on pyritic silver-gold ore from the Old Abe-Buffalo Boy group. Development work in 1930 totaled 1,298 feet; the mine is opened by a 2,000-foot adit and a 400-foot inside shaft (winze) from the adit. Equipment of the mill is as follows: 1 Blake 10 by 16 inch crusher, 1 cone crusher, 1 Leahy ¾-inch punch plate screen, 1 Marcy 6 by 5 foot ball mill, 1 Dorr 4 by 18⅓ foot classifier, 1 Wilfley table, 1 Minerals Separation 14-cell flotation machine, 1 Dorr filter, and 1 Dorr 12-foot thickening tank. The concentrates produced in 1930 were gold-silver, containing no copper or lead but a little zinc and averaging 10.4 per cent of silica, 38.2 per cent of iron, and 39.4 per cent of sulphur.

Production from the other mines mentioned on page 1072 consisted of small shipments only, the largest being 88 tons from the Royal Charter-Little Nation.

Eureka district (*Eureka, Silverton*).—A 7-ton clean-up shipment of gold-silver ore containing a little copper, lead, and zinc was shipped from the Gold King mine. The analysis of the ore was as follows: Silica 7.0 per cent, iron 37.7 per cent, sulphur 39.6 per cent, and zinc 2.7 per cent. The Sunnyside Mining & Milling Co., a subsidiary of the United States Smelting, Refining & Mining Co., mined and milled ore from the Sunnyside group at the rate of 1,000 tons a day to September 30; development work only was done during the remainder of the year. Development work in 1930 consisted of 4,096 feet of drifts, crosscuts, raises, winzes, and shafts. The company was one of the first (in 1917) in the United States to use selective flotation in the treatment of a complex low-grade zinc-lead-copper-iron-silver-gold sulphide ore. The present mill was built in 1917, and the practice as of 1926 was described by Robie.[8] The capacity of the present mill has been enlarged from time to time, from 500 tons a day to 1,000 tons rated capacity in 24 hours. As of March 9, 1931, the equipment was as follows: 2 Gates No. 6–K gyratory crushers (at the mine), 2 Farrel 13 by 30 inch jaw crushers, 3 Denver Engineering Works 5 by 14 and one 5 by 8 foot tube mills, 3 No. 86 Marcy 15 by 8 foot ball mills, 2 El Oro 5 by 8 foot ball mills, 18 Dorr duplex classifiers, 11 No. 6 Wilfley tables (for control), 1 Minerals Separation 10-cell 24-inch Sub A, 1 Minerals Separation 10-cell 24-inch Standard, 1 Minerals Separation 22-cell 24-inch Standard, 1 Minerals Separation 16-cell 24-inch Standard, and 1 Minerals Separation 6-cell 24-inch Sub A flotation machine, 1 Oliver 4 by 14 foot filter, 1 Portland 9 by 12 foot filter, 1 Portland 3½ by 12 foot filter, and 3 Dorr thickening tanks (one 8 by 25 foot, one 10 by 28 foot, and one 8 by 15 foot). Products from the mill in 1930 were: High-grade zinc concentrates (carrying also lead, copper, silver, and gold), of which most were shipped to the United States Zinc Co. retort plant at Amarillo, Tex. (residues from the zinc retorts going to El Paso, Tex.) and of which several thousand tons went to the sulphating plant at Durango, Colo.; high-grade lead-copper concentrates (carrying much more than half of the total recovered gold and silver), of which some were shipped to the Durango smelter and some to the sulphating plant; and zinc-lead-copper-silver-gold middlings, which went to the sulphating plant. At the Read-Coolbaugh sulphating plant at the Durango smelter the soluble zinc sulphate produced by the roasting was leached out; the residue went to the lead furnaces. Much of the zinc sulphate is sold as a chemical reagent for use in flotation plants.

SAN MIGUEL COUNTY

The mines of San Miguel County in 1930 produced only 13,393 tons of ore; it yielded, in terms of recovered metals, gold, silver, copper, and lead with a total gross calculated value of $165,538. The metal output was valued at $303,697 in 1929 and at $1,312,017 in 1928. The large decrease from 1928 to 1929 was caused by closing of the Smuggler-Union mine on December 11, 1928.

Iron Springs district (*Ophir*).—The Ophir district in 1930 produced 13,329 tons of ore yielding, in terms of recovered metals, $6,385 in gold, 85,556 ounces of silver, 34,100 pounds of copper, and 1,630,600 pounds of lead, with a total gross calculated value of $125,287, compared with $221,579 in 1929. The principal producing mine was the Carbonero. It is opened by a crosscut adit 2,200 feet long. Mining is done from levels above the adit. The upper levels are connected with the adit by a 400-foot incline shaft; drifts total 4,000 feet. No development was done in 1930. The mill was operated at a daily rate of 65 tons for approximately 200 days. The equipment of the mill is as follows: 1 Universal No. 3 crusher, 1 Ruth 3 by 9 foot rod mill, 1 Deister rougher table, 3 Deister pilot tables, 1 Ruth 8-cell flotation machine, and 4 settling tanks. The product was high-grade silver-lead concentrates. The Purdy Lease in 1930 reopened the Shoemaker group; drove 200 feet of drifts and a 40-foot raise; and built a mill equipped with 6 stamps, amalgamation plates, Pierce amalgamators, 1 Wilfley table, and 1 canvas table. The oxidized ore from this property yielded gold-silver amalgam bullion averaging 0.670 fineness in gold and 0.320 fineness in silver, and gold-silver concentrates containing also a little lead and zinc. Other ore shipped from the district was a 12-ton lot of gold-silver-copper-lead-[zinc] smelting ore to Durango from the Crown Point, an 87-pound lot of gold ore to the Golden Cycle mill from the Deadwood, and a 23-ton lot of lead-silver-gold ore to the Durango smelter from the Mary. The Butterfly-Terrible mine and mill were idle in 1930. The mill equipment consists of 1 Allis-Chalmers gyratory crusher, 1 vibrating screen, 1 Colorado Iron Works 5 by 6 foot ball mill, 1 Akins classifier, 2 Deister tables, 2 Fahrenwald 6-cell flotation machines, 1 American 3-leaf filter, 2 agitation tanks, and 1 Dorr 18-foot thickening tank. The product was lead-copper-silver-gold concentrates. The San Bernardo mine and mill remained idle in 1930. The equipment of the mill consists of 1 Gates gyratory crusher, 2 Allis-Chalmers 6 by 5 foot ball mills, 1 Dorr Duplex classifier, 1 Minerals Separation 12-cell flotation machine, 1 American continuous filter, and 1 agitation tank.

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[8] Robie, E. H., Selective Lead-Zinc Flotation at Sunnyside: Eng. and Min. Jour., vol. 121, 1926, pp. 542, 757–762.

Lower San Miguel district (*Sawpit, Vanadium*).—The Mount Wilson Mining & Milling Co. shipped several test lots, totaling 5 tons, of gold-silver ore to Utah smelters from Vanadium. The vanadium properties, closed in 1920, remained idle.

Upper San Miguel district (*Telluride*).—At the Smuggler-Union mine, closed December 11, 1928, gouging operations within the mine and clean-ups around the mill resulted in the shipment of gold-silver bullion to the Denver Mint and gold-silver-lead clean-up material to the Leadville and Durango smelters. Bullion also was shipped to the Denver Mint from clean-ups of other idle mills in the district and from several single-man operations.

SUMMIT COUNTY

The total gross calculated value of metals recovered from Summit County lode and placer mines was $141,582 in 1930, compared with $239,819 in 1929.

Breckenridge district.—The total gross calculated value of the combined output of lode and placer mines in the Breckenridge district in 1930 was $140,115.

From June 1 to August 1 a lessee on the Bemrose-Bostwick placer in Hoosier Gulch near Hoosier Pass handled 1,000 cubic yards of placer gravel by hydraulicking and recovered gold bullion worth $598.77; the bullion had a fineness of 0.811 in gold and 0.180 in silver. The property was then taken over by the Buffalo Exploration & Mining Co.. which tested the ground with an Ainlay gold separator; 490 yards of gravel yielded bullion worth $144.50 and having a fineness of 0.814¾ in gold and 0.182 in silver. The Continental Dredging Co. operated its electrically driven dredge equipped with 88 buckets, each with a capacity of 8½ cubic feet, from January 1 to December 15, and handled 1,340,000 cubic yards yielding bullion worth $131,407. The quantity in crude ounces was 8,003.03 before melting and 7,999.95 after melting, with a fineness of 0.790 in gold and 0.200 in silver. Company dredging operations in 1930 were confined to the B. & L. No. 2 placer and a small part of the Magnum Bonum placer. The Annie, Bryan, and Fairview claims have been dredged out. Several small sluicing operations in the district, including the Excelsior and Yuba Dam, yielded small quantities of placer gold, of which the fineness ranged from 0.778 to 0.811½ for gold and from 0.174 to 0.181 for silver.

The Royal Tiger 300-ton amalgamation-concentration mill was operated at a daily average of 150 tons during December on gold ore from the Cashier mine and produced gold-silver bullion with a fineness after melting of 0.668 for gold and 0.325 for silver. From another part of the company's property lessees shipped 4 cars of lead-silver ore to the Leadville smelter. The equipment of the Royal Tiger mill was described in the 1929 report of this series, but remodeling in November, 1930, included the installation of 5 silver-plated 5 by 10 foot copper amalgamating plates. The Wellington flotation mill remained idle.

Montezuma district.—The only shipment of ore from the Montezuma district in 1930 was a 23-ton lot of [zinc]-lead-silver ore to the Leadville smelter from the New York mine. The Montezuma Mines & Metals Corporation erected camp houses at the Bullion group and remodeled the old Bolivar mill. The Florado Mining Co. drove 100 feet of development work; erected some buildings; and installed power equipment at its holdings, which included among others the Celtic and Comstock patented claims, two of the original locations in the district. Two hundred feet of development work were done on the Hunki Dori, 440 feet on the Marlin, and 200 feet on the Ida Belle. The old 500-foot adit on the War Eagle was retimbered. Assessment work was done on several other properties.

Ten Mile district (*Frisco, Kokomo, Robinson*).—From the Ten Mile district in 1930 a 19-ton lot of lead-silver-gold ore was shipped to the Leadville smelter from the King Solomon Tunnel group, and a 972-pound lot of silver ore was shipped to the Golden Cycle mill from the Silver Queen property. Lessees on the Eureka, Senter, Dorset, and Gem placers in McNulty Gulch, with 640 feet of 18 by 24 inch sluice boxes, operated from April 8 to October 20 but found no gold until they reached the Eureka, from which they recovered 18.47 crude ounces of gold which when melted at the Denver Mint weighed 17.64 ounces, with a fineness of 0.857 for gold and 0.140 for silver.

TELLER COUNTY

Mine and dump siliceous sulphotelluride gold ores from the Cripple Creek district in 1930 aggregated in calculated recovered gold 122,487.05 ounces, valued at $2,532,032, and 8,691 ounces of silver, compared with $2,640,034 in gold and 9,244 ounces of silver in 1929. In these calculations account is taken of mill slags, clean-ups, and stolen specimen gold. Such accounting has been made in all previous reports of this series.

In 1930 the Golden Cycle mill at Colorado Springs held exclusively the market for Cripple Creek ores. The treatment rates for the Cripple Creek district for 1929 and 1930 up to September 1, 1930, were given in the 1929 report of this series. The rates effective September 1, 1930, follow.

Cripple Creek treatment rates, Golden Cycle mill, effective September 1, 1930

Ore up to and including $4 per ton	$1.85 plus $0.50 freight.
Over $4 and including $5 per ton	$1.85 plus $0.75 freight.
Over $5 and including $8 per ton	$2.35 plus $1 freight.
Over $8 and including $10 per ton	$4.15 (includes freight).
Over $10 and including $15 per ton	$5.45 (includes freight).
Over $15 and including $20 per ton	$6.50 (includes freight).
Over $20 and including $25 per ton	$6.85 (includes freight).
Over $25 and including $30 per ton	$7.40 (includes freight).
Over $30 and including $40 per ton	$8.00 (includes freight).
Over $40 and including $100 per ton	$9.10 (includes freight).
Over $100 per ton	$6.00 plus $3.10 freight.

Freight rate on ores of value over $100 per ton is $3.10 plus 1 per cent of value in excess of $100 unless the consignment be released to value not to exceed $100.

Rates subject to change at option of mill manager.

The Golden Cycle mill was described in the 1929 report of this series.

Since 1927 the Golden Cycle has been also a custom plant for gold and silver ores from other parts of the State. Beginning in November, 1929, the company completed a 300-ton selective flotation mill and began purchasing complex sulphide ores from other parts of the State, including zincky ores. The first shipment of zinc concentrates was made late in December, 1929. Owing to the drop in lead and zinc prices payment for zinc ceased in November, 1930.

Therefore, during 1930 the Golden Cycle mill actually consisted of three mills: (1) A 1,200-ton roast amalgamation-cyanidation mill; (2) a 40-ton nonroasting all-sliming unit, consisting of a sampler, Marcy ball mill, Dorr classifier, and Dorr thickener and agitating tanks; and (3) a 300-ton selective flotation mill. In 1930 several different flow sheets, including all three mills, were utilized. Some Cripple Creek sulphotelluride ores were floated, the concentrates going to the roaster and continuing through the amalgamation-cyanidation circuit. Tailings from the complex zinc-lead-copper-silver-gold ores went into the general cyanidation circuit. Some of the gold in the lead-gold concentrates was extracted by cyanidation before the lead concentrates were shipped to a lead smelter. Copper in the complex ores was separated selectively into copper concentrates or copper-lead concentrates and thus kept out of the cyanidation circuit. Sulphide gold-silver ores were treated by fine grinding without roasting and went thence into the general cyanidation circuit. Treatment rates for miscellaneous gold and silver ores as of August 22, 1930, follow.

Treatment rates for miscellaneous gold and silver ores only at the Golden Cycle mill, August 22, 1930

Ore up to and including $10 per ton	$3. 00
Over $10 and including $15 per ton	3. 50
Over $15 and including $20 per ton	4. 00
Over $20 and including $40 per ton	5. 00
Over $40 per ton	5. 50

On gold and silver ores, when silver content is 20 ounces or over per ton, $1 per ton will be added to the above rates.

An extra charge of $5 will be made for sampling all lots of ore containing less than 10 tons, dry weight, and $5 per lot made for each lot when more than one lot in a car.

An extra charge of 10 cents per ton made if ore is sacked.

The above rates are exclusive of freight charges.

Basis of payments:
- Gold—
  - $19.50 per ounce when settlement value is 0.50 ounce per ton or under.
  - $20.00 per ounce when settlement value exceeds 0.50 ounce per ton.
- Silver—Market quotation immediately preceding date of settlement, excluding fractions of cents, unless ore exceeds 100 ounces of silver per ton, in which event 2½ cents per ounce additional will be charged for ounces in excess of 100 ounces.

Silver contents:
- Pay 50 per cent on ore containing 1 ounce and including 5 ounces.
- Pay 65 per cent on ore over 5 ounces and including 10 ounces.
- Pay 75 per cent on ore over 10 ounces and including 20 ounces.
- Pay 85 per cent on ore over 20 ounces and including 50 ounces.
- Pay 90 per cent on ore over 50 ounces and including 100 ounces.
- Pay 95 per cent on ore over 100 ounces.

All new shippers, other than Cripple Creek, should send sample of ore for testing before billing carloads.

Rates subject to change at option of mill manager.

MINES REVIEW [9]

Mineral Hill.—No production was made from the Plutocrat prospect in 1930.

Carbonate Hill.—The Jay Gould Mining Co. continued development work for 9 months in 1930 and made several shipments of ore from the Kittie Wells.

Poverty Gulch.—From January to June a lessee shipped nearly 1,000 tons of dump material from the El Paso-Gold King. A lessee shipped from the Abe Lincoln mine and dump. An electrical hoist and compressor were installed at the C. O. D. shaft. Fifty feet of development work were done and 160 tons of ore shipped. The mine is opened by an 800-foot vertical shaft.

Hoosier Pass.—The Cudahy Gold Mining Co. shipped from the Hoosier property from March through September.

Tenderfoot Hill.—Lessees from the Reclamation Metal Mines Co. drove 400 feet of drifts on the property (Black Diamond and others) known as the Sangre de Christo Tunnel (1,900 feet long) and shipped ore during July, August, and September.

Rhyolite Mountain.—The Ellis Mining & Milling Co. made a small shipment from its property on Rhyolite Mountain.

Copper Mountain.—The United Gold Mines Co. cleaned out an old adit on Copper Mountain and in October made a trial shipment of zinc-lead-silver-gold sulphide ore to the Golden Cycle mill.

Globe Hill.—Surface material was shipped from the Deerhorn and dump material from the Keener Tunnel dump.

North Slope of Ironclad Hill.—The Oston Leasing Co. did 1,417 feet of development work on the Jerry Johnson and shipped 9,525 tons of ore; the property is opened by a 1,200-foot vertical shaft. The Oston Leasing Co. also operated and shipped ore from the Forest Queen. The Damon, Damon (Axtel), and W. P. H. group of the United Gold Mines Co. shipped 199, 809, and 3,984 tons of ore, respectively.

Gold Hill.—The Fanny Fern Mines Co. shipped ore from the Index. The Midget-Bonanza group was inoperative, but lessees shipped from the dump. A carload of ore was shipped from the Puzzler.

Raven and Guyot hills.—Producing mines were the Cresson, Doctor-Jack Pot dump, Economic mill dump, Elkton, Katinka dump, Mary

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[9] For convenience of study and to continue the record the order of the mines review follows the exact order of the detailed descriptions of mines in Lindgren, Waldemar, and Ransome, F. L., Geology and Gold Deposits of the Cripple Creek District, Colo.: U. S. Geol. Survey Prof. Paper 54, 1906, pp. 271–493.

McKinney, Queen dump, and Sheriff dump. The annual report of the Cresson Consolidated Gold Mining & Milling Co. for the 12 months ended August 31, 1930 (dated January 10, 1931), says:

> During the year 78,570 dry tons of ore were shipped of a gross value of $659,309.09, averaging $8.39 per ton; the returns, less transportation and treatment, were $393,534.24, giving the ore a net value of $5.01 per ton. The company received as additional income the sum of $7,658.70, interest on bank deposits, and $3,093.66, net royalty on 777 tons lessee ore, making a grand total of $404,286.60, with total expenses of $394,176.88, resulting in a net gain from operations of $10,109.72. The total cost per ton of ore produced was $5.01. This is an increase of $1.14 per ton over 1929. Increase in cost due to 40,000 tons smaller tonnage of ore produced.
>
> You will note in the company's production of 78,570 dry tons, with an average return of $5.14 per ton, the entire cost was $5.01 per dry ton, resulting in a net profit of 13 cents per ton.
>
> Total cash at the close of the fiscal year ending August 31, 1930, was $251,077.48.
>
> *Costs at the Cresson mine, fiscal year ended August 31, 1930*
>
> | | Per ton |
> |---|---|
> | General expense | $0. 01 |
> | Taxes | . 08 |
> | Insurance | . 15 |
> | Salary, officers | . 06 |
> | Colorado Springs office | . 08 |
> | Mining operations (includes mine management and engineering) | 4. 62 |
> | Depreciation | . 01 |
> | | 5. 01 |
>
> Following is a summary of development work for year ending August 31, 1930:
>
> *Development*
>
> | | Feet |
> |---|---|
> | Drifts and crosscuts | 7, 049 |
> | Raises and winzes | 1, 223 |
> | Total | 8, 272 |
>
> The mine showing on profits during the year past was small on account of decreased tonnage and values.
>
> In our last annual report mention was made of a new ore body originally on the 14 level. This ore of good grade on 14 only extended upwards about 80 feet and underneath the level seemed to be cut off at depth of 40 feet.
>
> Later development gives promise of extending this downward.
>
> The 10 upper levels have been opened to leasers, who are making a good production and profit for the company.
>
> The ore house dump has been shipping regularly at a small profit.
>
> The profits for the last few months have been fairly good.
>
> The ore house has been enlarged and changed to take care of lessees' ore.
>
> While no large reserves of ore have been developed, the present production can be kept up for some months.
>
> All equipment and the mine is in good condition.

Total production, Cresson Consolidated Mining & Milling Co., Colorado, 1903 to December 31, 1930

Period	Dry short tons	Gross value	Freight and treatment	Net value	Average gross value per ton	Average net value per ton	Dividends
1903 to Aug. 31, 1929	[1]1, 765, 540	[1]$31,878,673.53	[1]$9,448,716.91	[1]$22,429,956.62	$18. 05	$12. 70	$12,222,672.50
Sept. 1, 1929, to Aug. 31, 1930:							
Company ore	78, 570	659, 309. 09	265, 774. 85	393, 534. 24	8. 39	5. 01	
Lessee ore	777	9, 097. 02	3, 484. 70	5, 612. 32	11. 70	7. 22	
1903 to Aug. 31, 1930	1, 844, 887	32, 547, 079. 64	9, 717, 976. 46	22, 829, 103. 18	17. 64	12. 37	12, 320, 272. 50
1903 to Dec. 31, 1930	1, 868, 013	32, 746, 130. 96					12, 332, 472. 50

[1] Not including Dante and School Section.

At the Elkton 304 feet of drifts were run, and 17,772 tons of ore were shipped. The Le Clair Consolidated Mines Co. drove 1,500 feet of development on the Mary McKinney and shipped 5,500 tons. No underground work was done at the Queen group in 1930.

Beacon Hill.—A total of 3,700 tons was shipped from the El Paso dump in 1930. Shipments were made also from the Gold Dollar and Requa Savage dumps.

Bull Hill.—Producing mines on Bull Hill were the American, American Eagles dump, Big Banta, Dante, Favorite, Gold Pinnacle, Gold Sovereign, John A. Logan dump, Los Angeles, Lucky Gus, Orpha May, Trail, and War Eagle. The Cresson Co. worked the Dante. The Mexican Gold & Silver Mining Co. drove 1,553 feet of drifts and crosscuts, drove 612 feet of raises, and sank 161 feet of shaft. Total development on the property consisted of a 740-foot adit, a 656-foot vertical shaft, and 3,250 feet of drifts. The production from the Gold Pinnacle was 1,756 tons.

School Section 16.—The Kyner Leasing Co. shipped ore monthly from Block 8, School Section 16, T. 15 S., R. 69 W., which lies between Cameron and Altman.

Between Altman and Goldfield.—Producing mines between Altman and Goldfield were the Acacia, Deadwood, Empire Lee dump, Findley, Free Coinage dump, Pharmacist dump, Theresa, Victor dump, and Vindicator. At the Acacia 80 feet of drifting were done in 1930, and 1,620 tons of ore were shipped. At the Free Coinage 170 feet of drifting were done, and 2,179 tons of dump ore were shipped. The Deadwood, Theresa, and Vindicator were worked by the United Gold Mines Co.

Battle Mountain.—Producing mines were the Granite and Portland-Last Dollar, Rose Nicol, and Strong. Development work at the Granite consisted of 1,200 feet of drifts, 700 feet of crosscuts, and 125 feet of raises, a total of 2,025 feet.

The thirty-seventh annual report of the Portland Gold Mining Co., for 1930 (dated January 31, 1931), says:

> The outstanding disappointment of the year results from the pulling of the pumps from the bottom level. With pumping discontinued the water will eventually reach the drainage level. Decision to abandon the lower territory came only after we had exhausted all resources in the endeavor to find profitable ore on the lower levels. After due consideration of possibilities from the area to be involved and the very large expense resulting from the operation of the pumps, the action was deemed necessary. At this time the water is being held slightly below 2,300, which will permit the removal of the ore remaining in sight. It will be possible also to complete a crosscut that had been previously started on twenty-third level.
>
> On October 1, all company work was cut to the minimum and the mine further opened to lessees, and at this writing approximately 50 sets are actively engaged on the property.
>
> No ore is being mined on company account at this time, but thus far we have been able to keep two machines on development work. The development work by the company for the year under review equaled 3,614 feet and consisted of 2,066 feet of drifting, 1,413.5 feet of crosscutting, 61 feet raising, and 73.5 feet of winzes.
>
> At present the future of the mine appears none too promising; however, if we may anticipate only one fair stope of ore it would permit the starting of more machines on development work, and giving effect to the extensive undeveloped area owned by your company it would seem that some new ore should be opened.
>
> On Portland company account we shipped 17,815 dry tons of an average value of $9.35 per ton. The lessees from Portland shipped 14,496 dry tons, average value $10.19. Lessees on Last Dollar property shipped 7,730 dry tons, average value $7.07.

It is gratifying to report that all equipment is now in excellent condition and that no material expenditures are anticipated at this time.

Trial balance, Portland Gold Mining Co., Colorado, January 1, 1931

Value of ore in transit	$5, 113. 16	
Mill salvage		$31, 331. 76
Vouchers		5, 755. 05
Cash	4, 336. 68	
Mining property	4, 045, 229. 69	
Buildings and machinery	25, 001. 00	
Investments	19. 50	
Accounts payable		23, 903. 50
Accounts receivable	428. 11	
Insurance deposit—State	1, 000. 00	
Insurance suspense	2, 670. 47	
Taxes suspense		16, 927. 33
Bills receivable	2, 103. 02	
Reserve for depreciation		425, 208. 54
Reserve for depletion		1, 267, 821. 69
Bills—notes payable		30, 247. 45
Capital stock		3, 000, 000. 00
Surplus (deficit)	715, 293. 69	
	4, 801, 195. 32	4, 801, 195. 32

Statement of ore production of the Portland properties from April 1, 1894, to December 31, 1930

	Net tons	Gross value
From Apr. 1, 1894, to Dec. 31, 1929	6, 162, 357	$61, 621, 441. 38
From Jan. 1, 1930, to Dec. 31, 1930	40, 040	369, 106. 86
Grand total of ore production to date	6, 202, 397	61, 990, 548. 24

Total dividends paid to Jan. 1, 1931, $11,992,080.

Statement of all work on Portland properties to January 1, 1931

	Total during 1930, in feet	Total prior to 1930, in feet	Grand total, in feet
Drifts	2, 066	177, 621	179, 687
Crosscuts	1, 413	159, 698	161, 111
Raises	61	34, 126	34, 187
Winzes	74	7, 037	7, 111
Shafts	----------	13, 819	13, 819
	3, 614	392, 301	395, 915

Total for Portland mine, 74 miles, 5,195 feet.
Total for Independence mine, 17 miles, 1,917 feet (not included in total for Portland mine).

United Gold Mines Co.—The annual report dated January 1, 1931, of the United Gold Mines Co., an operating and holding company for property scattered throughout the Cripple Creek district, says:

> In addition to a larger operating gain, a great deal more development work, totaling 12,254 feet, almost 2½ miles, was done in 1930.
>
> This work opened numerous bodies of ore, but they were small. The work which has really added to the ore in sight during the past year was making accessible old levels in different properties owned by your company.
>
> In December a favorable lease was obtained on the Empire Lee property on Bull Hill, and it is being operated.

The work on Copper Mountain opened small bodies of good lead and zinc ore containing some silver. Owing to the low price of these metals work was discontinued, but it is planned to do some work on two claims of the same group near the recent strike on Mineral Hill.

There are numerous lessees working, but none have any large amount of ore developed.

It is planned to continue the vigorous development work of past years.

Operating statement, United Gold Mines Co., 1930

Receipts:	
Company ore sales	$281, 288. 12
Royalties	66, 743. 85
Miscellaneous earnings	2, 060. 03
Interest	3, 325. 36
Crusher No. 1 gain	2, 287. 43
Crusher No. 2 gain	1, 632. 32
Crusher No. 3 gain	835. 67
	358, 172. 78
Expenses:	
Cripple Creek office	1, 974. 59
Colorado Springs office	1, 838. 71
Officers' salaries	4, 750. 00
Fairview, operating expense	7, 731. 36
Bonanza, operating expense	41, 412. 17
Trail, operating expense	63, 944. 30
Vindicator, operating expense	110, 097. 83
Miscellaneous properties, operating expense	54. 88
Copper Mountain, operating expense	4, 804. 92
Damon, operating expense	7, 835. 31
Isabella, operating expense	462. 30
Solomon, operating expense	17. 21
Air sales	388. 72
Mine owners' association	143. 75
Fire insurance	60. 00
Taxes	8, 023. 41
Federal taxes	10, 511. 00
Balance net operating gain	94, 122. 32
	358, 172. 78

Profit and loss—recapitulation—United Gold Mines Co., 1930

Investment—sale of Jerry Johnson Mining Co	$24, 837. 25	
Bad debts charged off	835. 46	
Operating accounts, 1930	264, 050. 46	
Suspense account	68. 63	
Depreciation sustained	2, 085. 60	
Depletion sustained	37, 128. 70	
Dividends	48, 284. 05	
Bad debts collected and accounts unclaimed		$313. 28
Income accounts, 1930		358, 172. 78
Debit balance		18, 804. 09
	377, 290. 15	377, 290. 15

Total production of United Gold Mines property to December 31, 1930

	Net tons	Gross value
Ore mined before consolidation	26, 310	$456, 806. 19
Production under operations of the United Gold Mines Co	873, 988	10, 669, 927. 91
Total to Dec. 31, 1930	900, 298	11, 126, 734. 10

Production of the United Gold Mines Co.—Company ore in 1930

Group	Net tons	Gross value	Company ore cash receipts	Average gross value per ton
Bonanza	3,489	$52,272.20	$35,957.15	$14.98
Bonanza (Portland)	1,700	17,788.86	9,315.72	10.46
Copper Mountain	12	87.25		[1] .60
Damon	199	690.51	143.15	3.47
Fairview	299	3,632.35	1,912.68	12.15
Rose Nicol	6,176	27,898.59	11,640.36	4.52
Trail	3,744	143,741.59	116,251.35	38.32
Vindicator	20,341	172,491.02	106,067.71	8.48
Total, company	35,960	418,602.37	281,288.12	11.64

[1] Gold only.

Production of the United Gold Mines Co.—Lessee ore in 1930

Group	Net tons	Gross value	Royalties received	Lessees' receipts	Average gross value per ton
W. P. H	3,984	$27,940.39	$1,251.21	$11,797.20	$7.01
Axtel	809	17,537.81	2,379.86	9,292.33	21.69
Bonanza	98	2,843.64	883.84	1,132.25	29.00
Crusher No. 3	16	77.92	3.03	26.53	5.00
Deadwood	476	1,481.16	13.50	75.83	3.10
Freeport	29	252.25	10.51	92.06	8.80
Findley	10,493	33,836.04	975.43	8,454.76	3.23
Hardwood	2,934	59,359.18	8,609.39	33,210.15	20.23
Shurtloff	5,203	19,898.73	755.72	6,349.50	3.82
Trail	1,249	11,250.80	3,632.24	2,956.99	9.01
Theresa	4,939	66,738.27	20,653.04	23,562.45	13.51
Vindicator	14,886	124,590.93	27,576.08	49,416.49	8.37
Total, lessee	45,116	365,807.12	66,743.85	146,366.54	8.11

Development of the United Gold Mines Co. in 1930

	Feet
Bonanza	813
Copper Mountain	490
Damon	617
Fairview	627
Last Effort	104
Trail	2,395
Vindicator	2,985
Vindicator lessees	4,223
Total	12,254

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA [1]

(MINE REPORT)

By C. N. Gerry and T. H. Miller [2]

CONTENTS

	Page
Summary	1085
Mining industry	1091
Ore classification	1092
Metallurgic industry	1097
Review by counties and districts	1105
Cochise County	1106
Warren district (Bisbee, Lowell, Warren, Don Luis)	1108
Coconino County	1111
Gila County	1112
Globe district (Miami, Inspiration)	1113
Review by counties and districts—Cont.	
Graham County	1116
Greenlee County	1117
Maricopa County	1118
Mohave County	1120
Pima County	1122
Pinal County	1125
Santa Cruz County	1130
Yavapai County	1132
Verde district (Jerome)	1137
Yuma County	1141

SUMMARY

In 1930 the mines of Arizona produced gold, silver, copper, lead, and zinc valued at $81,042,416, a decrease of $74,524,717 (48 per cent) from 1929. The value of the production of the five metals, however, was much larger than that in any other State; the value of the copper represented more than 92 per cent of the total. The decrease of $74,524,717 in the value of the metal output was chiefly the result of the abnormal decrease in the output and average price of copper; the output of the other four metals and the average price of silver, lead, and zinc decreased also. As the average price of copper fell from 17.6 cents a pound in 1929 to 13 cents in 1930 (as low as 9.78 cents in December), most of the large producers of copper curtailed their output considerably. The United Verde, United Verde Extension, Inspiration, Miami Copper, Magma, Calumet and Arizona, Arizona Commercial, and Iron Cap mining companies paid dividends (partly estimated) amounting to about $16,000,000. In addition, the Phelps Dodge Corporation, operating mines at Bisbee and Morenci, Ariz., and in New Mexico and Mexico, paid $5,911,342; and the Nevada Consolidated Copper Co., operating mines at Ray, Ariz., McGill, Nev., and Santa Rita, N. Mex., paid $7,893,057.

The average value in metals recovered per ton of ore, old tailings, slag, etc., decreased from $5.93 in 1929 to $4.01 in 1930; the average value per ton in gold and silver decreased from 32 to 28 cents.

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[1] Work on manuscript completed March, 1932.

[2] The assistance of Paul Luff and LaRu Shepherd, of the Bureau of Mines, is appreciated.

The chief producing counties in 1930, in order of total value of metals recovered, were Gila, Cochise, Yavapai, Pinal, Pima, and Greenlee, all large copper producers. Gold was recovered chiefly from Yavapai, Cochise, Mohave, Pima, Pinal, Gila, and Greenlee Counties; the decrease in the total output of gold, the result of curtailment in output of copper ore, came chiefly from Yavapai and Cochise Counties. Silver came largely from Yavapai, Cochise, and Pinal Counties. Lead was recovered chiefly from Santa Cruz, Gila, Cochise, Graham, and Pinal Counties. Nearly all the zinc came from Santa Cruz County.

During the decade from 1921 to 1930, 62 per cent of the gold was recovered from copper ore and 34 per cent from dry and siliceous ore. In recent years, except 1930, gold from copper ore has been increasing gradually, whereas gold from siliceous ore has been decreasing. In 1930, however, gold from siliceous ore (chiefly gold ore) was more than double that in 1929, but gold from copper ore decreased more than 26 per cent. Gold was also saved from lead ore and from mixed ores; very little came from placers. During this 10-year period copper ore was the chief source of silver, with smaller amounts from siliceous ore and lead ore. Silver from copper ore increased from 1921 to 1926, decreased in 1927, increased in 1928 and 1929, and decreased decidedly in 1930. Silver from dry and siliceous ore has been decreasing generally since 1923; although the amount increased slightly in 1927 and 1928, it declined considerably in 1929 and 1930. Silver from lead ore has decreased steadily since 1923.

The value of metal production herein reported has been calculated at the figures given in the table that follows. Gold is figured at the mint value for fine gold; that is, $20.671835 an ounce. The silver price is average New York price for bar silver. The copper, lead, and zinc prices are weighted averages, for each year, of all grades of primary metal sold by producers.

Prices of silver, copper, lead, and zinc, 1926–1930

Year	Silver	Copper	Lead	Zinc	Year	Silver	Copper	Lead	Zinc
	Per fine ounce	*Per pound*	*Per pound*	*Per pound*		*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1926	$0.624	$0.140	$0.080	$0.075	1929	$0.533	$0.176	$0.063	$0.066
1927	.567	.131	.063	.064	1930	.385	.130	.050	.048
1928	.585	.144	.058	.061					

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1926–1930, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1926	362	21	22,382,685	234,010.97	$4,837,436	7,381,027	$4,605,761
1927	293	15	21,991,874	200,494.59	4,144,591	6,847,680	3,882,635
1928	298	22	22,828,766	191,927.23	3,967,488	6,791,351	3,972,940
1929	390	22	25,860,772	202,318.14	4,182,287	7,543,283	4,020,570
1930	301	41	19,802,919	169,390.38	3,501,610	5,540,732	2,133,182

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1926–1930, in terms of recovered metals—Continued

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1926	723, 296, 051	$101, 261, 447	23, 258, 274	$1, 860, 662	12, 946, 423	$970, 982	$113, 536, 288
1927	682, 190, 547	89, 366, 962	19, 865, 961	1, 251, 556	2, 268, 960	145, 213	98, 790, 957
1928	732, 276, 803	105, 447, 860	14, 380, 964	834, 096	1, 278, 636	77, 997	114, 300, 381
1929	830, 628, 411	146, 190, 600	16, 054, 122	1, 011, 410	2, 458, 580	162, 266	[1] 155, 567, 133
1930	576, 190, 607	74, 904, 779	8, 491, 623	424, 581	1, 630, 506	78, 264	81, 042, 416

[1] Corrected figure.

GOLD

In 1930 the production of gold in Arizona was $3,501,610, the smallest output in any year since 1921 and a decrease of more than 16 per cent from 1929. The largest decreases occurred in Yavapai and Cochise Counties and were due chiefly to the marked curtailment in the output of copper ore at the United Verde, Copper Queen, and Calumet and Arizona mines. The unusually large increase in the output of siliceous gold ore from the Tom Reed mine at Oatman, Mohave County, prevented a much larger decrease in the production of gold in Arizona in 1930. Decided decreases in gold production were reported by the United Verde, Copper Queen branch of the Phelps Dodge Corporation, Calumet and Arizona, Arizona-Eastern, New Cornelia, United Verde Extension, Tonopah-Belmont, and Old Dominion companies. Of the total output of gold, 17.26 per cent was recovered from ore and old tailings treated in gold and silver mills, 21.50 per cent from ore and old tailings concentrated, and 60.67 per cent from crude ore shipped for smelting. Ore and old tailings treated by amalgamation yielded gold valued at $11,256 in 1930, compared with $9,113 in 1929, and ore and old tailings treated by cyanidation in 1930, $593,008, compared with $133,047 in 1929. Concentrates yielded gold valued at $752,939 in 1930, compared with $1,009,135 in 1929, and crude ore smelted, $2,124,344, compared with $3,008,295 in 1929. The chief gold-producing districts in 1930 were the Verde in Yavapai County, the Warren in Cochise County, the San Francisco in Mohave County, the Ajo in Pima County, the Pioneer in Pinal County, the Globe in Gila County, and the Greenlee in Greenlee County; all of these except the San Francisco district produced copper ore.

The United Verde Copper Co. was as usual the largest producer of gold in Arizona in 1930; it was followed by the Tom Reed mine at Oatman, the Calumet and Arizona property near Bisbee, the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, the New Cornelia mine at Ajo, the United Verde Extension mine at Jerome, the Magma mine at Superior, the Shattuck-Denn property near Bisbee, the Morenci branch of the Phelps Dodge Corporation at Morenci, and the Old Dominion property at Globe.

SILVER

The production of silver in Arizona in 1930 decreased more than 26 per cent; the value decreased 47 per cent, as the average price of silver declined from 53.3 cents an ounce in 1929 to 38.5 cents in 1930. The decrease in the output of silver, as well as that in gold, was due to the curtailed output of copper ore, as most of the silver and gold from Arizona is recovered from copper bullion. The silver production of the State was more than 7,000,000 ounces in 1916, 1923, 1925, and 1926; in 1927 the output declined to 6,847,680 ounces and in 1928 to 6,791,351 ounces. The output in 1929 increased to 7,543,283 ounces, the largest ever recorded in the State, but decreased to 5,540,732 ounces in 1930; however, the State maintained its position as the fourth largest producer of silver in the United States after Utah, Idaho, and Montana. Decreases in the output of silver were made in all counties except Graham and Maricopa, and the decreases in Yavapai, Cochise, Pinal, and Gila Counties were unusually large. The largest decrease was made by the United Verde Copper Co.; other companies that reported decided decreases in silver were the Calumet and Arizona, Magma, Copper Queen branch of the Phelps Dodge Corporation, United Verde Extension, Gold Crown Silver, Shattuck-Denn, and Eagle-Picher Lead (Montana mine). Good increases were made by the Florence Lead & Silver, Trench (World's Fair mine), Red Rover, Sheldon, and Christmas properties. Bullion from ore and old tailings treated at gold and silver mills contained 26,063 ounces of silver recovered by cyanidation and 276 ounces recovered by amalgamation. Concentrates yielded 28 per cent of the total output of silver and crude ore shipped to smelters nearly 71 per cent.

Of the total silver produced in Arizona in 1930 nearly 75 per cent came from ore of the United Verde, Calumet and Arizona, Copper Queen branch of the Phelps Dodge Corporation, and United Verde Extension mines, each of which produced more than 350,000 ounces of silver. Other mines that yielded more than 95,000 ounces of silver each in 1930 were the Shattuck-Denn, Montana (Eagle-Picher Lead), New Cornelia, and Morenci branch of the Phelps Dodge Corporation.

COPPER

The production of copper in Arizona in 1930 was 576,190,607 pounds—less than any annual output since 1922 and a decrease of nearly 31 per cent from the record output of 830,628,411 pounds in 1929. The output in 1930, however, was more than three times that in 1921, when most of the large copper mines were closed. From 1904 to 1930, inclusive, the State produced 6,601,930 short tons of copper, and in 1930 the output exceeded the combined output of Montana and Utah (the States next in order) by nearly 200,000,000 pounds. As the average price of copper fell from 17.6 cents a pound in 1929 to 13 cents in 1930 nearly all the large producers of copper curtailed their output to a marked degree; this resulted in unusually large decreases in copper production in Yavapai, Cochise, Pinal, Gila, Pima, and Greenlee Counties. The largest decreases were made by the United Verde, Inspiration, Copper Queen branch of the Phelps Dodge Corporation, Nevada Consolidated (Ray mines), New Cornelia, United Verde Extension, Calumet and Arizona, and Morenci branch of the Phelps Dodge Corporation; each of these decreased its output of copper more than 13,000,000 pounds, and four of them more than 30,000,000 pounds. The Miami Copper Co. was the only large producer that increased its output of copper in 1930; good increases were also made by the Christmas Copper Co. and the

Van Dyke Copper Co. Of the total copper produced in the State in 1930, 52 per cent was obtained from concentrates, 34 per cent from crude ore smelted, more than 11 per cent from ore leached, and 2 per cent from mine-water precipitates. Of the total output from crude ore smelted Yavapai County yielded 48 per cent and Cochise County 42 per cent; most of the remainder came from Pinal, Gila, and Greenlee Counties. The copper from ore milled came mainly from Gila, Pinal, Pima, Greenlee, Cochise, and Yavapai Counties. The low-grade disseminated ores in Cochise, Gila, Greenlee, Pima, Pinal, and Yavapai Counties, treated by concentration or leaching, yielded 297,728,809 pounds of copper in 1930, or more than half the total copper produced in the State.

Ten properties, each yielding more than 32,000,000 pounds, produced nearly 91 per cent of the total copper from Arizona in 1930. The Copper Queen branch of the Phelps Dodge Corporation was first, followed by the United Verde, Miami, Inspiration, New Cornelia, Morenci branch of the Phelps Dodge Corporation, United Verde Extension, Calumet and Arizona, Nevada Consolidated (Ray mines), and Magma mines. Other mines that produced more than 3,500,000 pounds of copper each were the Old Dominion, Shattuck-Denn, Christmas, Verde Central, and Arizona Commercial.

LEAD

The production of lead in Arizona decreased from 16,054,122 pounds in 1929 to 8,491,623 pounds in 1930, the smallest output in any year since 1921 and only slightly more than half of the average annual output for the decade 1921 to 1930. In 1916 a record production of 27,062,087 pounds of lead was made, and in 1917, 1925, and 1926 the output of the State was more than 23,000,000 pounds annually. The abnormal drop in metal prices in 1930 resulted in the closing of the large producing lead mines in Arizona. The 79 Lead-Copper Co. in Gila County, which produced more than 36 per cent of the State's output of lead in 1929, suspended ore shipments in June, 1930, and consequently its output of lead was only about one-third of that in 1929. Large decreases in output of lead were also made from the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, Cochise County; from the Belmont-MacNeill mine near Palo Verde, Maricopa County; from the Montana mine of the Eagle-Picher Lead Co. near Ruby, Santa Cruz County; and from old tailings shipped from the Grand Central dump near Tombstone, Cochise County. The Tombstone Mining Co., a new company organized in 1930 to operate property near Tombstone, Cochise County, produced more than 800,000 pounds of lead; this prevented a larger decrease in the State production. Good increases in lead output were made from the Grand Reef mine near Aravaipa, Graham County, and from the Sunrise & Sunshine group near Ajo, Pima County. Of the total lead produced in Arizona in 1930 more than 32 per cent was recovered from concentrates and nearly 68 per cent from crude ore smelted. Most of the lead produced from ore concentrated came from lead-zinc ore from property near Ruby, Santa Cruz County. About 58 per cent of the lead produced from crude ore smelted came from oxidized lead ore from 3 mines—1 near Hayden Junction, Gila County, 1 near Tombstone, Cochise County, and 1 near Aravaipa, Graham County.

The largest producers of lead in Arizona in 1930 were the Montana (Eagle-Picher Lead), 79 Lead-Copper, Tombstone Extension (Tombstone Mining Co.), Grand Reef, and Blue Bird mines; these five properties yielded 67 per cent of the total lead output of the State. Considerable lead was also produced from properties near Patagonia, Santa Cruz County, and near Pantano, Pima County.

ZINC

The production of zinc in Arizona decreased from 2,458,580 pounds in 1929 to 1,630,506 pounds in 1930. The decrease was due chiefly to the closing in April of the mill of the Eagle-Picher Lead Co. at its Montana mine near Ruby, Santa Cruz County, after the drastic drop in metal prices. The company was the only large producer of zinc in Arizona in 1928, 1929, and 1930. Small quantities of zinc were produced in 1930 from mines near Chloride, Mohave County, Patagonia, Santa Cruz County, and Venezia, Yavapai County. Mines in Arizona made a record output of 20,894,860 pounds of zinc in 1917; considerable zinc was also produced in 1915 and 1916—18,220,863 and 19,677,949 pounds, respectively. Most of the zinc produced during these three years came from the Tennessee and Golconda mines near Chloride, Mohave County.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1930, by counties, in terms of recovered metals

County	Gold					Silver (lode and placer)	
	Lode		Placer		Total value	Fine ounces	Value
	Fine ounces	Value	Fine ounces	Value			
Cochise	48,387.82	$1,000,265	7.40	$153	$1,000,418	1,811,904	$697,583
Coconino						8	3
Gila	5,943.74	122,868			122,868	219,998	84,699
Graham	59.07	1,221	1.01	21	1,242	24,290	9,352
Greenlee	3,628.99	75,018	7.65	158	75,176	96,283	37,069
Maricopa	707.92	14,634	12.00	248	14,882	69,591	26,792
Mohave	28,708.43	593,456	26.85	555	594,011	25,942	9,988
Pima	11,913.46	246,273	60.61	1,253	247,526	136,574	52,581
Pinal	8,912.51	184,238			184,238	989,837	381,087
Santa Cruz	1,604.84	33,175			33,175	231,080	88,966
Yavapai	58,328.11	1,205,749	405.57	8,384	1,214,133	1,930,906	743,399
Yuma	563.86	11,656	110.54	2,285	13,941	4,319	1,663
	168,758.75	3,488,553	631.63	13,057	3,501,610	5,540,732	2,133,182
Total, 1929	202,044.71	4,176,635	273.43	5,652	4,182,287	7,543,283	4,020,570

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	128,405,179	$16,692,673	1,350,100	$67,505			$18,458,179
Coconino	2,861	372					375
Gila	165,776,725	21,550,974	1,906,290	95,315			21,853,856
Graham	66,571	8,654	759,781	37,989			57,237
Greenlee	43,144,044	5,608,726					5,720,971
Maricopa	259,807	33,775	172,243	8,612			84,061
Mohave	2,617	340	37,640	1,882	35,104	$1,685	607,906
Pima	50,600,212	6,578,028	545,735	27,287			6,905,422
Pinal	68,761,598	8,939,008	738,364	36,918			9,541,251
Santa Cruz	568,945	73,963	2,659,090	132,954	1,585,472	76,103	405,161
Yavapai	117,690,154	15,299,720	236,620	11,831	9,930	476	17,269,559
Yuma	911,894	118,546	85,760	4,288			138,438
	576,190,607	74,904,779	8,491,623	424,581	1,630,506	78,264	81,042,416
Total, 1929	830,628,411	146,190,600	16,054,122	1,011,410	2,458,580	162,266	[1] 155,567,133

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[1] Corrected figure.

Ore, old tailings, etc., sold or treated, lode mines producing, and average value of ore, etc., in gold and silver in Arizona, 1929 and 1930, by counties

County	Ore, old tailings, etc. (short tons)		Lode mines producing		Average value per ton in gold and silver	
	1929	1930	1929	1930	1929	1930
Cochise	2,826,186	1,994,220	41	32	$0.97	$0.85
Coconino	1,270	21	5	2	.39	.14
Gila	11,439,598	9,965,806	39	25	.03	.02
Graham	621	2,836	5	5	6.81	3.73
Greenlee	1,745,012	1,379,915	6	3	.09	.08
Maricopa	18,353	3,647	15	20	4.22	11.36
Mohave	10,569	29,835	44	22	15.66	20.23
Pima	3,617,735	2,375,974	59	31	.12	.13
Pinal	3,893,128	2,608,643	40	37	.22	.22
Santa Cruz	46,338	29,862	38	36	4.10	4.09
Yavapai	2,255,441	1,395,527	66	65	1.41	1.40
Yuma	6,521	16,633	32	23	7.98	.80
	25,860,772	19,802,919	390	301	.32	.28

MINING INDUSTRY

In the early months of 1930 the mining industry of Arizona was in an unusually flourishing condition following a year of record output. Important improvements had been made in the mines. mills, and smelting plants of the State, and the price of copper was still sufficiently high to induce the chief operators to uphold the record output. After March, however, the price of copper started to decline, conditions changed, and from April to the end of the year the marked curtailment at large mines materially reduced the total metal output of the State. The drop in metal prices, particularly that of copper, followed by the general curtailment in production, not only resulted in a large decrease in the production of copper from Arizona but also changed the order of output of the three leading mining districts. In 1929 the Verde (Jerome) district ranked first in production of copper, the Globe (Miami) district second, and the Warren (Bisbee) district third. In 1930 there was such a marked decrease in the output from the Verde (Jerome) district, particularly during the latter half of the year, that the Globe (Miami) district took first place as a producer of copper in Arizona. The largest decreases for 1930 occurred at the United Verde mine at Jerome, the Inspiration mine near Miami, the Copper Queen branch of the Phelps Dodge Corporation at Bisbee, the Ray mines of the Nevada Consolidated Copper Co. at Ray, the New Cornelia mine at Ajo, the United Verde Extension property at Jerome, the Calumet and Arizona mine at Bisbee, and the Morenci branch of the Phelps Dodge Corporation. After the close of the year the production of copper was again curtailed on account of the exceedingly low price of the metal, although the mines and plants of Arizona were kept in condition for immediate resumption of normal production. Conditions at many of the large mines of Arizona were described in detail in various articles published in 1930 and early in 1931, to which reference is made in the review by counties and districts. A general article[3] on the metal mines of the United States, dealing with mining and costs by different methods, was published in June, 1931.

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[3] Wright, C. W., Mining Methods and Costs at Metal Mines of the United States: Inf. Circ. 6503, Bureau of Mines, 1931, 39 pp.

ORE CLASSIFICATION

Ore, old tailings, etc., sold or treated in Arizona in 1930, with content in terms of recovered metals

Source	Mines producing	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold ore	86	[1] 48,538	33,047.09	65,073	43,720	7,138	
Dry gold and silver ore	4	1,822	347.53	15,786	3,559	800	
Dry silver ore	11	[2] 3,393	88.84	105,343	16,765	11,736	
Copper ore	139	[3] 19,703,349	[4] 132,086.77	[5] 4,968,973	[6] 575,656,380	43,846	
Lead ore	72	21,807	1,243.15	222,541	277,893	5,781,614	
Copper-lead ore	14	[7] 1,309	359.80	20,491	85,660	625,080	
Lead-zinc ore	5	22,701	1,585.57	142,440	106,624	2,021,404	1,630,506
Total, lode mines	[8] 301	19,802,919	[4] 168,758.75	[5] 5,540,647	[6] 576,190,607	8,491,623	1,630,506
Total, placers	41		631.63	85			
	342	19,802,919	[4] 169,390.38	[5] 5,540,732	[6] 576,190,607	8,491,623	1,630,506
Total, 1929	412	25,860,772	[9] 202,318.14	[10] 7,543,283	[11] 830,628,411	16,054,122	2,458,580

[1] Includes 859 tons of old tailings and 3 tons of mill cleanings sold to a smelter, 4 tons of old tailings concentrated, 180 tons of old tailings amalgamated, and 15,432 tons of old tailings cyanided.
[2] Includes 450 tons of old tailings sold to a smelter.
[3] Includes 2,680,734 tons of ore leached and concentrated, 459,832 tons of ore leached, and 989 tons of smelter cleanings, 787 tons of old slag, and 136 tons of old tailings sold to a smelter.
[4] Includes 0.26 ounce of gold recovered from precipitates.
[5] Includes 300 ounces of silver recovered from precipitates.
[6] Includes 12,700,073 pounds of copper recovered from precipitates.
[7] Includes 2 tons of mill cleanings sold to a smelter.
[8] A mine producing more than one class of ore is counted but once in arriving at total for all classes.
[9] Includes 1.55 ounces of gold recovered from precipitates.
[10] Includes 307 ounces of silver recovered from precipitates.
[11] Includes 13,233,543 pounds of copper recovered from precipitates.

Value of metals from ore, old tailings, etc., sold or treated in Arizona in 1930, by classes of ore

Class	Ore, old tailings, etc. (short tons)	Gold	Silver	Copper	Lead	Zinc	Total
Dry gold ore	48,538	$683,144	$25,053	$5,684	$357		$714,238
Dry gold and silver ore	1,822	7,184	6,078	463	40		13,765
Dry silver ore	3,393	1,836	40,557	2,180	587		45,160
Copper ore	19,703,349	[1] 2,730,476	[1] 1,913,055	[1] 74,835,329	2,192		79,481,052
Lead ore	21,807	25,698	85,678	36,126	289,081		436,583
Copper-lead ore	1,309	7,438	7,889	11,136	31,254		57,717
Lead-zinc ore	22,701	32,777	54,839	13,861	101,070	$78,264	280,811
	19,802,919	[1] 3,488,553	[1] 2,133,149	[1] 74,904,779	424,581	78,264	82,029,326
Total, 1929	25,860,772	[2] 4,176,635	[2] 4,020,548	[2] 146,190,600	1,011,410	162,266	155,561,459

[1] Includes value of 0.26 ounce of gold, 300 ounces of silver, and 12,700,073 pounds of copper recovered from precipitates.
[2] Includes value of 1.55 ounces of gold, 307 ounces of silver, and 13,233,543 pounds of copper recovered from precipitates.

GOLD ORE

Gold ore, old tailings, etc., which represented about one-fourth of 1 per cent of the total output of ore, old tailings, etc., were reported from 79 mines and 7 dumps in 1930. This material, the production of which decreased more than 29 per cent from 1929, yielded on the average $14.07 in gold and 1.34 ounces of silver to the ton and a little copper and lead; it was valued at $14.72 in metals a ton. The decrease was due to the suspension of shipments of siliceous fluxing material from the Copper Queen mine at Bisbee, Cochise County. The total output of gold from siliceous gold ore, however, was more than double that in 1929, as the Tom Reed Gold Mining Co. at Oatman, Mohave County, materially increased its output of gold ore. More than half of the gold ore and old tailings was produced from 20 mines and dumps in Mohave County, chiefly from mines at Oatman; most of the remainder came from 30 mines and dumps in Yavapai County, largely old tailings from the Congress dump. The quantity of gold ore treated by cyanidation in 1930 was nearly three times that in 1929; a large quantity of old tailings was also treated by cyanidation. The largest producers of gold ore and old tailings were the Tom Reed mine at Oatman, Mohave County; the Congress tailings dump at Congress, Yavapai County; the Bunker Hill Mines Co. at Tombstone, Cochise County; and the Gold Road tailings dump at Goldroad, Mohave County.

GOLD AND SILVER ORE

Four mines in four counties reported the production of gold and silver ore. This material, the production of which decreased from 9,377 tons in 1929 to 1,822 tons in 1930, yielded on the average $3.94 in gold and 8.66 ounces of silver to the ton and a little copper and lead; it was valued at $7.55 in metals a ton. The apparent decrease in the quantity of gold and silver material in 1930 was due to the fact that much of the material mined in 1930 contained less silver and was therefore classed as gold ore. Nearly all the gold and silver ore produced in 1930 came from the Commonwealth mine near Pearce, Cochise County.

SILVER ORE

A total of 10 mines and 1 tailings dump in 6 counties reported the production of silver ore and old tailings. This material, the output of which was a little less than one-third that in 1929, yielded on the average 54 cents in gold and 31.05 ounces of silver to the ton, 0.25 per cent of copper, and 0.17 per cent of lead; it was valued at $13.31 in metals a ton. The Florence Lead & Silver Mines (Inc.), operating property near Ray, and the Reymert mine near Superior, both in Pinal County, were the largest producers of silver ore in Arizona in 1930. The Reymert mine, a producer of more than 7,400 tons of silver ore in both 1927 and 1928, decreased its output to about 4,700 tons in 1929 and to about 800 tons in 1930.

COPPER ORE

Of the copper ore, slag, etc., produced in 1930 at 139 mines and dumps in Arizona, 16,519,830 tons came from 8 low-grade disseminated deposits worked by 7 companies, whose mines are near Globe, Christmas, Ray, Ajo, Bisbee, Morenci, and Hillside. The crude copper ore mined and smelted (without concentration) amounted to 2,032,680 tons, more than 96 per cent of which was sulphide material. In 1930 the total copper ore, etc., sold or treated, which represented 99.5 per cent of the total output of ore, etc., in the State, decreased 23 per cent; it yielded on the average 14 cents in gold and 0.252 ounce of silver to the ton, 1.43 per cent of copper, and a little lead and was valued at $3.95 in metals a ton, compared with $5.87 in 1929. The total value of the metals recovered from copper ore, etc., represented 98 per cent of the total value of the metal output of the State. The largest producers of copper ore were the Miami, Inspiration, New Cornelia, Nevada Consolidated (Ray mines), Copper Queen branch of the Phelps Dodge Corporation, Morenci branch of the Phelps Dodge Corporation, and United Verde properties. The largest producers of copper ore for direct shipment to a smelter were the United Verde, Calumet and Arizona, Copper Queen branch of the Phelps Dodge Corporation, and United Verde Extension mines.

LEAD ORE

The output of lead ore decreased from 46,476 tons in 1929 to 21,807 tons in 1930. In 1930 this material yielded on the average $1.18 in gold and 10.21 ounces of silver to the ton, 13.26 per cent of lead, and 0.64 per cent of copper and was valued at $20.02 in metals a ton. The output of lead ore from the 79 mine near Hayden Junction, Gila County, was only about one-third of that in 1929, as the company suspended shipments in June because of low metal prices. There was also a decided decrease in shipments of lead ore from the Copper Queen mine at Bisbee, Cochise County, and from the Grand Central dump near Tombstone, also in Cochise County, a large producer of old lead tailings in 1929 but inactive in 1930. Good increases in production of lead ore were made at the Tombstone Extension property near Tombstone, Cochise County; at the Grand Reef mine near Aravaipa, Graham County; and at the Sunrise & Sunshine group near Ajo, Pima County. Considerable lead ore was also produced from mines near Patagonia, Santa Cruz County.

ZINC ORE

No zinc ore was produced in 1930 from mines in Arizona, although 3 cars of oxidized zinc ore were shipped in 1929 from a property near Gleeson, Cochise County.

COPPER-LEAD ORE

Fourteen mines in seven counties made the output of 1,309 tons of copper-lead ore, etc., a decrease from 18,608 tons in 1929. In 1930 the material yielded on the average $5.68 in gold and 15.65 ounces of silver to the ton, 3.27 per cent of copper, and 23.88 per cent of lead and was valued at $44.09 in metals a ton. Nearly all the copper-lead ore came from the Belmont-MacNeill property near Palo Verde, Maricopa County, and the Blue Bird group near Mammoth, Pinal County. The large decrease in copper-lead material in 1930 was due to the suspension in January of mining and milling operations at the Belmont-MacNeill mine by the Tonopah Belmont Development Co.; the company mined and milled more than 55,000 tons of copper-lead ore from 1926 to January, 1930.

LEAD-ZINC ORE

The output of lead-zinc ore decreased from 34,421 tons in 1929 to 22,701 tons in 1930. This ore, produced by five mines in 1930, yielded on the average $1.44 in gold and 6.27 ounces of silver to the ton, 0.235 per cent of copper, 4.45 per cent of lead, and 3.59 per cent of zinc; it was valued at $12.37 in metals a ton. In 1930, as in 1929, nearly all the lead-zinc ore came from the Montana mine near Ruby, Santa Cruz County, but the output was much less than in 1929 as operations were seriously affected by the drop in metal prices.

COPPER-LEAD-ZINC ORE

No copper-lead-zinc ore was produced from mines in Arizona in 1930, although more than 1,000 tons were produced and milled in 1929 from property near Chloride, Mohave County; the property was closed in 1929 because of the serious drop in the price of silver, lead, and zinc.

Ore, old tailings, etc., sold or treated in Arizona in 1930, by counties, with content in terms of recovered metals

DRY GOLD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	5, 425	1, 505. 27	30, 685	15, 108		
Gila	162	100. 92	374	660		
Graham	2	2. 85				
Maricopa	[1] 67	94. 02	29	105		
Mohave	[2] 29, 491	28, 601. 36	21, 761	16		
Pima	54	61. 73	160	144	2, 759	
Pinal	163	63. 68	78	415		
Santa Cruz	2	4. 60	2			
Yavapai	[3] 12, 884	2, 212. 56	11, 911	25, 840	4, 379	
Yuma	[4] 288	400. 10	73	1, 438		
	48, 538	33, 047. 09	65, 073	43, 726	7, 138	
Total, 1929	68, 891	14, 428. 87	37, 511	1, 076, 115	20, 136	

DRY GOLD AND SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Cochise	1, 794	336. 64	15, 224	3, 426		
Mohave	23	7. 69	353	88	800	
Pima	4	. 20	14	40		
Santa Cruz	1	3. 00	195	5	6	
	1, 822	347. 53	15, 786	3, 559	806	
Total, 1929	9, 377	1, 477. 56	79, 340	38, 084	36, 467	

DRY SILVER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Cochise	[5] 775	24. 90	3, 924	645	11, 736	
Gila	15		9	275		
Maricopa	1		77			
Pinal	2, 533	63. 24	97, 792	14, 332		
Santa Cruz	44	. 40	3, 148	1, 485		
Yavapai	25	. 30	393	28		
	3, 393	88. 84	105, 343	16, 765	11, 736	
Total, 1929	11, 636	175. 56	286, 657	130, 721	7, 933	

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[1] Includes 30 tons of old tailings amalgamated.

[2] Includes 2 tons of mill cleanings sold to a smelter, 4 tons of old tailings concentrated, and 5,432 tons of old tailings cyanided.

[3] Includes 859 tons of old tailings and 1 ton of mill cleanings sold to a smelter and 10,000 tons of old tailings cyanided.

[4] Includes 150 tons of old tailings amalgamated.

[5] Includes 450 tons of old tailings sold to a smelter.

Ore, old tailings, etc., sold or treated in Arizona in 1930, by counties, with content in terms of recovered metals—Continued

COPPER ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	1,981,082	47,918.66	[6] 1,709,958	[6] 128,332,306	2,085	
Coconino	21		8	2,861		
Gila	[7] 9,059,546	5,518.01	194,066	[6] 165,601,707	3,430	
Greenlee	1,379,915	2,028.39	90,279	[6] 43,144,044		
Maricopa	2,914	323.92	64,003	229,313		
Mohave	6	11.40	8	458		
Pima	[8] 2,372,403	11,802.73	123,492	50,583,991	89	
Pinal	2,604,829	[6] 8,091.93	[6] 870,868	[6] 68,668,670		
Santa Cruz	4,707	41.99	6,943	[6] 434,840	1,127	
Yavapai	[9] 1,381,804	56,038.11	1,894,446	[6] 117,667,665	36,093	
Yuma	16,121	111.63	2,907	910,272		
	19,703,349	[6] 132,086.77	[6] 4,968,973	[6] 575,656,380	43,832	
Total, 1929	25,669,975	[6] 179,488.76	[6] 6,598,986	[6] 828,414,224	357,211	

LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Cochise	5,081	602.05	51,908	48,261	1,327,997	
Gila	6,083	324.80	25,549	113,795	1,902,840	
Graham	2,834	56.20	24,290	66,571	779,781	
Maricopa	2	1.00	2		1,011	
Mohave	16	.32	110		10,170	
Pima	3,477	47.49	12,222	10,771	545,808	
Pinal	654	49.65	2,088	9,807	317,770	
Santa Cruz	2,702	64.40	81,839	26,415	662,405	
Yavapai	734	45.10	23,211	2,089	178,092	
Yuma	224	52.14	1,322	184	85,760	
	21,807	1,243.15	222,541	277,893	5,781,614	
Total, 1929	46,476	2,787.97	249,575	506,079	10,418,025	

COPPER-LEAD ORE

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Cochise	62	0.30	203	5,233	8,282	
Maricopa	663	289.00	5,477	30,389	171,232	
Mohave	[10] 2	1.00	78	192	717	
Pima	36	1.30	676	5,266	7,088	
Pinal	464	44.60	13,011	38,474	420,614	
Santa Cruz	22	.60	282	1,602	5,714	
Yavapai	60	23.00	764	4,504	11,447	
	1,309	359.80	20,491	85,660	625,094	
Total, 1929	18,608	1,822.82	62,809	279,086	2,162,116	

LEAD-ZINC ORE [11]

County	Ore, old tailings, etc.	Gold	Silver	Copper	Lead	Zinc
Mohave, Santa Cruz, and Yavapai	22,701	1,585.57	142,440	106,624	2,021,404	1,630,506
	22,701	1,585.57	142,440	106,624	2,021,404	1,630,506
Total, 1929 [11]	35,809	1,863.17	228,363	183,507	3,072,254	2,458,580

[6] Includes metal recovered from precipitates.

[7] Includes 2,680,734 tons of ore leached and concentrated.

[8] Includes 459,832 tons of ore leached and 787 tons of old slag and 95 tons of smelter cleanings sold to a smelter.

[9] Includes 136 tons of old tailings and 894 tons of smelter cleanings sold to a smelter.

[10] Mill cleanings sold to a smelter.

[11] Figures for 1929 represent zinc ore, lead-zinc ore, and copper-lead-zinc ore.

Zinc products (as marketed from Arizona mines and mills) sold to smelters in 1930

Classification	County	Quantity (dry weight)	Gross zinc	Average assay of ore or concentrates	Recovered zinc
		Short tons	*Pounds*	*Per cent*	*Pounds*
Oxidized lead zinc ore	Santa Cruz	243	149,202	30.70	130,806
Zinc concentrates	Mohave, Santa Cruz, and Yavapai.	1,537	1,740,843	56.63	1,499,700
		1,780	1,890,045	53.09	1,630,506
Total, 1929		2,877	2,893,977	50.30	2,458,580

METALLURGIC INDUSTRY

Of the total ore, old tailings, etc., produced in Arizona in 1930, 14,556,169 tons (73.51 per cent) were ore and old tailings treated by concentration, with subsequent smelting of concentrates; 3,140,566 tons (15.86 per cent) were ore leached, with electrolytic precipitation; 2,062,840 tons (10.42 per cent) were ore shipped crude to smelters; and 40,118 tons (0.203 per cent) were ore and old tailings treated by amalgamation or cyanidation, chiefly the latter. The quantity of ore treated by amalgamation or cyanidation had been declining steadily in recent years; but in 1930 the ore treated by cyanidation was nearly three times that treated in 1929, as a result of the decided increase in the output of siliceous gold ore from the Tom Reed mine at Oatman, Mohave County. An unusually large quantity of old tailings from the Congress dump near Congress Junction, Yavapai County, was treated by cyanidation. The quantity of ore treated by amalgamation in 1930 was about the same as that treated in 1929. The quantity of ore leached decreased more than 27 per cent from that in 1929, crude ore shipped to smelters decreased 37 per cent, and ore and old tailings concentrated decreased 20 per cent.

Ten smelting plants within the State, all but one treating copper material, were active during the year; and considerable ore from Arizona was treated at El Paso, Tex. The copper smelter of the Southwest Metals Co. (Sheldon Mining Co.) was rebuilt in 1929 and operated about four months early in 1930. The lead smelter of the Phelps Dodge Corporation at Douglas was closed in April. Large decreases in the output of blister copper were reported from all the Arizona smelting plants, particularly from the United Verde smelter at Jerome, the copper plants of the Phelps Dodge Corporation and Calumet and Arizona Mining Co. at Douglas, the plant of the American Smelting & Refining Co. at Hayden, and the plant of the International Smelting Co. at Miami, each of which reported a decrease of more than 18,000,000 pounds of blister copper. Large decreases in the output of lead bullion were reported at the plants of the Phelps Dodge Corporation at Douglas and the American Smelting & Refining Co. at El Paso, Tex. There was a substantial increase in copper recovered at El Paso, Tex., from material from mines in Arizona. An article[4] describing operations of the El Paso plant was published in 1930. The new electrolytic copper refinery of the Nichols Copper Co. at El Paso, Tex., was placed in operation early in 1930. The plant has a capacity of 100,000 tons of electrolytic copper a year and was described in detail in three articles[5] published in 1930. The new casting plants for making copper anodes for shipment to the new refinery at El Paso, erected in 1929 at the Clifton and Douglas smelters of the Phelps Dodge Corporation and at the Douglas smelter of the Calumet and Arizona Mining Co., were operated in 1930. New construction at Arizona smelting plants during 1930 included the completion of the new receiving, crushing, sampling, bedding, and reclaiming system at the Copper Queen smelter of the Phelps Dodge Corporation at Douglas and the erection of a new acid plant and the installation of new roasters and converters at the Douglas smelter of the Calumet and Arizona Mining Co.

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[4] Marble, E. R., Smelter Equipment Trends: Eng. and Min. Jour., vol. 129, June 7, 1930, p. 565.

[5] Robie, E. H., A Trip Through the New Nichols Copper Refinery at El Paso, Tex.: Eng. and Min. Jour., vol. 129, Jan. 9, 1930, p. 5; Furnace and Casting Equipment of the New Nichols Refinery: Eng. and Min. Jour., vol. 129, Jan. 23, 1930, p. 73.

Corwin, F. R., and Harloff, C. S., El Paso Refinery of the Nichols Copper Co.: Min. and Met., October, 1930, p. 459.

Fifty-seven milling plants in Arizona were active in 1930. Twenty-nine were concentration plants, of which 7 used gravity machines without flotation equipment, 5 combined gravity and flotation machines, and 17 straight flotation. Sixteen mills were equipped for amalgamation, 3 for amalgamation and concentration, 5 for cyanidation, and 4 for leaching.

Large mills and leaching plants in Arizona active in 1930

Name of company	Location of mill	Method of treatment	Rated capacity of mill	Class of ore and old tailings treated	Product
			Short tons per day		
American Smelting & Refining Co.	Swansea	Flotation	250	Copper	Copper concentrates.
Bagdad Copper Corporation.	Bagdad	do	200	do	Do.
Calumet and Arizona Mining Co. (New Cornelia mines).	Ajo	do	15,000	do	Do.
Do	do	Leaching	5,000	do	Electrolytic copper.
Christmas Copper Co.	Christmas	Flotation	400	do	Copper concentrates.
Eagle-Picher Lead Co. (Montana mine).	Ruby	do	300	Lead-zinc	Lead concentrates and zinc concentrates.
Gold Road Mining Co	Oatman	Cyanidation.	150	Gold	Gold bullion.
Inspiration Consolidated Copper Co.	Inspiration	Flotation	18,000	Copper	Copper concentrates.
Do	do	Leaching	9,000	do	Electrolytic copper.
Do	do	Slime-leaching.	500	do	Copper precipitates
Katherine Gold Mining Co	Katherine	Cyanidation.	250	Gold	Gold bullion.
Magma Copper Co	Superior	Gravity and flotation.	600	Copper	Copper concentrates.
Miami Copper Co	Miami	Flotation	18,000	do	Do.
Nevada Consolidated Copper Co. (Ray mines).	Hayden	do	12,000	do	Do.
Old Dominion Copper Co.	Globe	do	1,700	do	Do.
Phelps Dodge Corporation:					
Copper Queen branch.	Warren	do	4,800	do	Do.
Morenci branch	Morenci	Gravity and flotation.	5,500	do	Do.
Sheldon Mining Co	Walker	Flotation	200	Copper-lead	Copper concentrates and lead concentrates.
Southwest Metal Extraction Corporation.	Congress	Cyanidation.	400	Gold	Gold bullion.
Tom Reed Gold Mining Co.	Oatman	do	250	do	Do.
United Verde Copper Co	Clarkdale	Flotation	1,600	Copper	Copper concentrates.
United Verde Extension Mining Co.	Clemenceau.	do	200	do	Do.
Verde Central Mines (Inc.).	do	do	400	do	Do.

In 1930 the ore treated by amalgamation amounted to 899 tons; this ore and 180 tons of old tailings yielded $10.43 in gold and 0.256 ounce of silver to the ton. Ore treated by cyanidation amounted to 23,607 tons; this ore and 15,432 tons of old tailings yielded $15.19 in gold and 0.668 ounce of silver to the ton. The total value of the bullion recovered from ore and old tailings was $614,405, compared with $151,331 in 1929. The unusually large increase in 1930 was due chiefly to the decided increase in the output of siliceous gold ore from the Tom Reed mine at Oatman, Mohave County; the ore was treated in the company's 250-ton cyanidation mill. During 1930 cyanidation mills consumed about 52,600 pounds of sodium and potassium cyanide, an average of 0.96 pound per ounce of gold and silver bullion saved and 1.347 pounds per ton of ore and old tailings treated. Amalgamation mills used or purchased about 125 pounds of quicksilver, an average of 0.152 pound per ounce of gold and silver bullion saved and 0.116 pound per ton of ore and old tailings treated.

Mine production of metals at gold and silver mills in Arizona in 1930, by counties, in terms of recovered metals

County	Ore and old tailings treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Ore	Old tailings	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Cochise	33	------------	9.20	7	4.00	200
Gila	3	------------	3.27	------------	------------	------------
Maricopa	7	30	19.78	5	2.07	1
Mohave	24,047	5,432	303.21	146	28,176.79	21,506
Pinal	116	------------	34.44	22	------------	------------
Yavapai	[1] 297	10,000	129.51	85	503.91	4,356
Yuma	3	150	45.11	11	------------	------------
	[1] 24,506	15,612	544.52	276	28,686.77	26,063
Total, 1929	9,162	80	440.83	3,143	6,436.17	14,063

[1] Also produced 12 tons of concentrates yielding 16.74 ounces of gold, 82 ounces of silver, and 3,316 pounds of lead.

New construction work at the larger concentrating plants consisted chiefly of completing remodeling programs started in 1929. At the New Cornelia property at Ajo the new ore bins, crushing and screening plants, and conveyor system were completed, rod mills and ball mills were enlarged, and three new sections were added to the plant, raising its capacity to about 15,000 tons a day. The enlargement and improvement of the Miami concentrator were completed early in the year, as was the new crushing plant at the Morenci mill. The addition of new ball mills and classifiers at one section of the Copper Queen concentrator near Bisbee resulted in an increase of about 70 per cent in the capacity of the section. The capacity of the United Verde mill at Clarkdale was greatly increased by the addition of another mill section. A new 200-ton flotation plant was constructed by the United Verde Extension Mining Co. at Clemenceau, and a 250-ton flotation plant was built by the American Smelting & Refining Co. at the Clara-Swansea property in Yuma County. The Bagdad Copper Corporation enlarged its mill near Hillside, Yavapai County, and increased its daily capacity from 50 to 200 tons. The new mill of the Verde Central Mines (Inc.) near Jerome was closed during the year, as was the large concentrator of the Inspiration Consolidated Copper Co. at Miami. Except for the plant of the Miami Copper Co., all the large copper concentrators in Arizona were operated at reduced capacity in 1930.

Data giving the original contents of the ores concentrated in Arizona are presented in the following tables, which also show the class, quantity, and contents of the concentrates made from each class of ore, by methods of concentration, and the metallurgic recoveries obtained by the use of flotation. A report[6] on flotation reagents used in the United States in 1929 was issued by the Bureau of Mines in 1931; the report on this subject for 1930, giving the flotation reagents used and the kinds and grade of ore, has been issued as a chapter of Mineral Resources. Attention is also called to the special articles on milling plants mentioned in the following review by counties and districts.

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[6] Miller, T. H., and Kidd, R. L., Flotation Reagents, 1929: Rept. of Investigations 3112, Bureau of Mines, 1931, 20 pp.

Arizona ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates

Class of material concentrated	Method of concentration	Ore and old tailings concentrated	Gross content of mill feed				
			Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper sulphide ore	Flotation	[1] 13,113, 992	33, 622. 34	884, 984	288, 624, 617	51, 926	
Lead-zinc sulphide ore	do	22, 458	1, 703. 94	168, 150	153, 993	2, 277, 169	2, 624, 605
		13, 136, 450	35, 326. 28	1, 053, 134	288, 778, 610	2, 329, 095	2, 624, 605
Copper sulphide ore	Gravity and flotation	1, 568, 308	11, 087. 65	792, 349	76, 286, 910		
Copper-lead sulphide ore	do	663	458. 73	8, 426	58, 207	228, 100	
Lead sulphide ore	do	564	4. 58	19, 693	1, 296	147, 565	
		1, 569, 535	11, 550. 96	820, 468	76, 346, 413	375, 665	
Siliceous gold ore and old tailings	Gravity	[2] 206	232. 02	2, 231	170		
Siliceous silver ore	do	25	. 40	490	40		
Copper sulphide ore	do	800	4. 00	200	100, 000		
Copper-lead sulphide ore	do	2	1. 00	12	60	156	
Lead sulphide ore	do	4, 060	262. 03	12, 458	9, 414	589, 860	
		5, 093	499. 45	15, 391	109, 684	590, 016	
Total		[3] 14,711, 078	47, 376. 69	1, 888, 993	365, 234, 707	3, 294, 776	2, 624, 605

[1] Includes 151,909 tons of copper ore first treated by leaching.

[2] Includes 4 tons of old tailings.

[3] Figures do not include 120 tons of siliceous gold ore treated by amalgamation and concentration.

Arizona ore and old tailings concentrated in 1930, by classes of ore, etc., methods of concentration, and classes of concentrates—Continued

Class of material concentrated	Method of concentration	Concentrates produced		Gross content of concentrates				
		Class	Quantity	Gold	Silver	Copper	Lead	Zinc
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper sulphide ore	Flotation	Copper sulphide	630,751	23,942.03	656,251	246,081,057		
		Lead sulphide	62	252.45	2,716	1,417	41,541	
			630,813	24,194.48	658,967	246,082,474	41,541	
Lead-zinc sulphide ore	do	Iron sulphide	40	22.82	55	100	671	
		Lead sulphide	1,862	1,416.82	128,328	119,263	2,152,129	
		Zinc sulphide	1,537	145.93	14,057	16,169	61,207	1,740,843
			3,439	1,585.57	142,440	135,532	2,214,007	1,740,843
			634,252	25,780.05	801,407	246,218,006	2,255,548	1,740,843
Copper sulphide ore	Gravity and flotation	Copper sulphide	203,932	9,922.75	735,860	66,968,525		
Copper-lead sulphide ore	do	Copper-lead sulphide	150	289.00	5,477	37,986	190,278	
Lead sulphide ore	do	Lead sulphide	141	3.90	16,739	1,102	125,410	
			204,223	10,215.65	758,076	67,007,613	315,688	
Siliceous gold ore and old tailings	Gravity	Siliceous gold	[4] 33	198.56	1,926	137		
Siliceous silver ore	do	Siliceous silver	5	.30	393	30		
Copper sulphide ore	do	Copper sulphide	224	2.07	129	84,122		
Copper-lead sulphide ore	do	Copper-lead sulphide	1	.81	10	49	125	
Lead sulphide ore	do	Lead sulphide	562	209.26	10,230	7,285	484,291	
			825	411.00	12,688	91,623	484,416	
Total			[5] 839,300	36,406.70	1,572,171	313,317,242	3,055,652	1,740,843

[4] Includes 2 tons of siliceous gold concentrates from old tailings.

[5] Figures do not include 12 tons of concentrates from ore treated by amalgamation and concentration, containing 16.74 ounces of gold, 82 ounces of silver, and 3,593 pounds (3,316 pounds recovered) of lead.

Metallurgic results obtained by flotation of Arizona ores and by concentration of Arizona ores and old tailings in 1930

Material treated	Concentrates produced	Ratio of concentration	Per cent recovered in concentrates				
			Gold	Silver	Copper	Lead	Zinc
Ore by flotation:							
Copper sulphide	Copper sulphide	20.79:1	71.21	74.15	85.26		
Lead-zinc sulphide	Iron sulphide		1.34	.03	.06	0.02	
	Lead sulphide	12.06:1	83.15	76.32	77.45	94.42	
	Zinc sulphide	14.61:1	8.56	8.36	10.50	2.79	66.33
Total lead-zinc sulphide		6.53:1	93.05	84.71	88.01	97.23	66.33
Total ore by flotation		20.71:1	72.98	76.10	85.26	96.84	66.33
Ore by gravity and flotation:							
Copper sulphide	Copper sulphide	7.69:1	89.49	92.87	87.79		
Copper-lead sulphide	Copper-lead sulphide	4.42:1	63.00	65.00	65.26	83.41	
Lead sulphide	Lead sulphide	4.00:1	85.15	85.00	85.03	85.00	
Total ore by gravity and flotation.		7.69:1	88.44	92.40	87.77	84.03	
Total ore and old tailings by all methods.		17.53:1	76.85	83.23	85.79	92.74	66.33
Total, 1929		17.26:1	76.15	85.43	84.63	89.43	67.09

Gross metal content of Arizona concentrates produced in 1930, by classes of concentrates

Class of concentrates	Concentrates produced (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	80	225.96	2,378	267	371	
Copper	834,907	33,866.85	1,392,240	313,133,704		
Lead	2,637	1,894.89	158,091	129,067	2,804,894	
Zinc	1,537	145.93	14,057	16,169	63,507	1,740,843
Copper-lead	151	289.81	5,487	38,035	190,383	
	839,312	36,423.44	1,572,253	313,317,242	3,059,155	1,740,843
Total, 1929	1,056,821	48,816.90	2,124,957	430,823,567	5,648,719	2,835,077

Mine production of metals from Arizona concentrates in 1930, in terms of recovered metals

BY COUNTIES

	Ore and old tailings to concentrating mills		Concentrates and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	1,090,110		152,371	3,151.00	84,245	34,039,110	24,995	
Gila	7,197,677		[1] 163,081	5,328.14	179,086	101,529,153	15,856	
Greenlee	1,354,397		114,988	3,393.99	82,845	39,268,368		
Maricopa	663		150	289.00	5,477	30,389	171,232	
Mohave	297	4	111	132.78	3,661	1,888	25,953	35,104
Pima	1,909,959		115,997	11,791.90	128,888	42,132,613	322,184	
Pinal	2,541,133		202,895	7,111.65	682,877	60,992,689	22,273	
Santa Cruz	24,097		3,542	1,495.95	138,706	218,743	1,968,796	1,454,666
Yavapai	422,415		[2] 84,536	3,726.03	264,993	23,042,252	159,834	9,930
Yuma	15,417		1,641	3.00	1,475	813,954	36,369	
	14,556,165	4	[1 2] 839,312	36,423.44	1,572,253	302,069,159	2,747,492	1,499,700
Total, 1920	18,235,550	208	1,056,821	48,816.90	2,124,957	414,998,247	5,103,350	2,411,460

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[1] Includes 1,031 tons of concentrates made from slimes from a leaching plant.

[2] Includes 12 tons of concentrates from ore amalgamated.

Mine production of metals from Arizona concentrates in 1930, in terms of recovered metals—Continued

BY CLASSES OF CONCENTRATES

	Concentrates and recovered metal					
	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	80	225.96	2,378	221	352	----
Copper	834,907	33,866.85	1,392,240	301,922,928		----
Lead	2,637	1,894.89	158,061	104,134	2,521,687	----
Zinc	1,537	145.93	14,057	11,448	54,168	1,499,700
Copper-lead	151	289.81	5,487	30,428	171,345	----

Copper ore constituted 98.5 per cent of the first-class material smelted. The mines of the Verde district, Yavapai County, and those of the Warren district, Cochise County, together produced 90 per cent of the copper ore smelted. Lead ore smelted ranked second in quantity and dry and siliceous ore third. Most of the lead ore of smelting grade came from the Banner district in Gila County, the Tombstone district in Cochise County, the Aravaipa district in Graham County, and the Harshaw district in Santa Cruz County. Nearly half of the dry and siliceous ore smelted was gold ore from a property near Tombstone, Cochise County; most of the remainder was silver ore from two properties in Pinal County and gold and silver ore from a property near Pearce, Cochise County.

Gross metal content of Arizona crude ore shipped to smelters in 1930, by classes of ore

Class of ore	Quantity (dry weight)	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	12,092	3,834.08	153,394	56,430	19,984	----
Copper	2,032,680	97,832.06	3,563,482	208,814,609	14,026	----
Lead	17,183	1,029.99	195,572	300,433	5,891,894	----
Copper-lead	642	68.99	14,926	57,884	512,552	
Lead-zinc	243	----	----	----	34,506	149,202
	2,062,840	102,765.12	3,927,374	209,229,356	6,472,962	149,202
Total, 1929	3,266,575	145,526.26	5,352,804	342,766,097	11,563,616	58,900

Mine production of metals from Arizona crude ore shipped to smelters in 1930, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	903,627	45,209.62	1,725,411	82,143,538	1,325,105	----
Coconino	21	----	8	2,861	----	----
Gila	87,392	612.32	40,912	6,703,354	1,890,434	----
Graham	2,836	59.05	24,290	66,571	759,781	----
Greenlee	25,518	235.00	13,434	3,715,666	----	----
Maricopa	2,947	397.09	64,105	229,418	1,011	----
Mohave	51	73.54	547	521	10,970	----
Pima	5,301	120.95	7,406	362,827	223,531	----
Pinal	67,394	1,766.15	306,927	7,711,772	716,091	----
Santa Cruz	5,765	108.91	92,374	348,360	690,294	130,806
Yavapai	960,925	53,666.73	1,649,144	94,162,693	76,786	----
Yuma	1,063	515.76	2,816	97,940	49,391	----
	2,062,840	102,765.12	3,927,374	195,545,521	5,743,414	130,806
Total, 1929	3,266,575	145,526.26	5,352,804	319,953,705	10,231,950	47,120

Mine production of metals from Arizona crude ore shipped to smelters in 1930, in terms of recovered metals—Continued

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	12, 092	3, 834. 08	153, 394	53, 773	16, 364	
Copper	2, 032, 680	97, 832. 06	3, 563, 482	195, 166, 470	7, 142	
Lead	17, 183	1, 029. 99	195, 572	270, 238	5, 240, 726	
Copper-lead	642	68. 99	14, 926	55, 040	453, 028	
Lead-zinc	243				26, 154	130, 806

Miscellaneous material other than ore and old tailings milled and crude ore smelted consisted of 3,226 tons of old tailings, slag, and plant clean-up shipped for smelting and 3,140,566 tons of ore leached; this material yielded 338.64 ounces of gold, 14,381 ounces of silver, 65,875,854 pounds of copper, and 717 pounds of lead. The copper came chiefly from ore leached and the gold, silver, and lead chiefly from old tailings and plant clean-up. In addition 0.26 ounce of gold, 300 ounces of silver, and 12,700,073 pounds of copper were recovered from precipitates.

Arizona holds an important position in leaching operations compared with other copper-producing States. Two plants, in Gila and Pima Counties, make fine copper after leaching copper ore in tanks followed by electrolytic deposition. At two other properties, in Cochise and Yavapai Counties, copper precipitates were shipped from heap leaching of copper ores; precipitates were also recovered from copper-bearing mine water. The oxidized ore treated at the New Cornelia leaching plant at Ajo decreased from about 1,122,000 tons in 1929 to about 460,000 tons in 1930; consequently, the output of electrolytic copper was less than half that in 1929. Operations were suspended at the Ajo leaching plant in July, but the plant is in good condition and ready for resumption of operations when market conditions warrant it. Continued research at the Inspiration leaching plant has resulted in important changes in method of operation. Leaching-plant losses were found to be due largely to poor circulation of solutions caused by the channeling effect of the extremely fine material in the charge. The removal of the primary slime from the charge greatly increased the copper extraction in the leaching tanks; and in May a new plant, designed to treat the slime product by a combination of flotation and agitation leaching, was placed in operation. As a result of these changes the over-all recovery of the plant has been materially increased.

REVIEW BY COUNTIES AND DISTRICTS

In addition to the special articles to which reference is made under the following district reviews, attention is called to an article[7] published in August which described the changes made at the New Cornelia, Copper Queen, Calumet and Arizona, Denn, Morenci, Bagdad, and other properties in Arizona. Reference is also made to a general bulletin,[8] published by the United States Bureau of Mines in 1930, which gives recent data on the mine openings, development, and ventilation of the Morenci, Ray, Inspiration, Miami, Magma,

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[7] Young, G. J., Mining and Metallurgical Developments in Arizona: Eng. and Min. Jour., vol. 130, Aug. 9, 1930, p. 127.

[8] McElroy, G. E., Ventilation of the Large Copper Mines of Arizona: Bull. 330, Bureau of Mines, 1930, 145 pp.

Old Dominion, Copper Queen, Calumet and Arizona, United Verde, and United Verde Extension mines. Another publication dealing with the general mining industry of the State is the mineral industries bulletin [9] of the Arizona Bureau of Mines.

COCHISE COUNTY

In Cochise County the production of each of the metals was less in 1930 than in 1929, and there was a marked decrease in copper. The total value of the metals decreased $17,401,411, chiefly because of curtailment in the output of copper at Bisbee. There were 34 mines producing, 7 less than in 1929. The value of the copper output decreased from $32,909,033 to $16,692,673, gold from $1,461,427 to $1,000,418, silver from $1,288,232 to $697,583, and lead from $197,788 to $67,505; the value of the zinc output in 1929 was $3,110, but no zinc was produced in Cochise County in 1930. The total value of the metals decreased from $35,859,590 to $18,458,179. The value of the metal output of Cochise County was second to that of Gila County, the largest in the State. The yield of each metal is given in the table on page 1090. Ore of smelting grade (903,627 tons) yielded on the average $13.66 in metals a ton, compared with $17.38 in 1929. Of the ore smelted 891,173 tons were classified as copper ore, of which 10,288 tons were estimated to be oxidized ore and 880,885 tons sulphide ore. The lead ore (5,081 tons) was shipped to El Paso, Tex., and Douglas, Ariz., and yielded 602.05 ounces of gold, 51,908 ounces of silver, 48,261 pounds of copper, and 1,327,997 pounds of lead. First-class lead ore amounted to 4,881 tons, and all but 116 tons was oxidized. Copper ore of milling grade yielded 152,314 tons of copper concentrates, all shipped for smelting. The remainder of the output from Cochise County was siliceous ore and old tailings (mostly siliceous gold ore), nearly all shipped for smelting. Only 3 tons of siliceous gold ore were treated by amalgamation, and 30 tons of gold and silver ore were treated by cyanidation. The placer output amounted to $153 in gold and 2 ounces of silver.

California district.—Four lode mines in the California district produced 187 tons of ore yielding $6 in gold, 826 ounces of silver, 7,751 pounds of copper, and 35,449 pounds of lead, valued in all at $3,104, a decrease from $5,547 in 1929. The only important production from the California district in 1930 was from the Sunset mine at Hilltop, which produced five cars of mixed oxidized and sulphide lead ore for smelting. One car of copper-lead ore was shipped from the Ainsworth property operated by the Coronado Copper Corporation, one lot of siliceous silver ore was mined from the Scott property by lessees, and one lot of oxidized copper-lead ore was marketed from the New Veil mine.

Cochise and Golden Rule districts (*Johnson, Dragoon*).—Six lode mines in the Cochise and Golden Rule districts produced 1,414 tons of first-class ore yielding $184 in gold, 1,681 ounces of silver, 145,415 pounds of copper, and 33 pounds of lead, valued in all at $19,737, or $13.96 in metals a ton. The output in 1929 was valued at $13,729 and that in 1928 at $9,897. The chief producer was the Mammoth &

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[9] Tenney, J. B., Second Report on the Mineral Industries of Arizona: Arizona Bureau of Mines Bull. 129, July 1, 1930, 108 pp.

Republic group operated by the Arizona United Development Co., which shipped about 1,000 tons of dump material containing copper and silver. Other producers of copper ore were the Keystone, Peabody, Climax, and Burnell properties. Some low-grade gold ore was shipped from the Red Bird group at Cochise. The Keystone Copper Co. marketed 4 cars of first-class copper ore and did 375 feet of drifting in 1930, but the 300-ton flotation mill at the mine was idle.

Dos Cabezas and Teviston districts.—Two placers and four lode mines in the Dos Cabezas and Teviston districts produced 284 tons of ore, $3,841 in gold, 1,925 ounces of silver, 2,836 pounds of copper, and 50,030 pounds of lead, valued in all at $7,452. The ore had an average value of $25.70 in metals a ton. The LeRoy property at Dos Cabezas was operated part of the year by the LeRoy Consolidated Mines Co., which shipped two cars of lead ore rich in gold and silver, and for a time by the V. M. P. Leasing Co., which concentrated some of the ore and shipped several cars of lead concentrates. One car of gold and silver ore was shipped from a prospect near Dos Cabezas, and small lots of gold ore and gold bullion were marketed from the Henry Clay (Gold Prince) property 3 miles northeast of Dos Cabezas. A little gold ore from the Golden Slope claim was treated by amalgamation. The placer gold, valued at $153, was recovered chiefly from the property of the Apache Chief Placer Mining Co.

Huachuca Mountain district.—No ore was shipped from the Lucy Bell property in the Huachuca Mountain district in 1930; but the compressor plant was rebuilt, 4,000 feet of mine workings were cleaned out, and grading was done for a 50-ton mill. The ore is said to contain tungsten as well as copper, lead, and silver.

Swisshelm district (Webb, Elfrida).—The Four-Horse Mining Co. operated the Four-Horse and Apex properties near Elfrida, which are opened by about 400 feet of underground workings. The operators mined 200 tons of lead ore but did not market it in 1930.

Tombstone district.—Three lode mines in the Tombstone district produced 8,734 tons of ore yielding $38,746 in gold, 74,937 ounces of silver, 32,903 pounds of copper, and 936,862 pounds of lead, valued in all at $118,717, or $13.59 in metals a ton, a decrease from $155,959 in 1929. The output in 1930 was all first-class ore of smelting grade. The largest part of the production consisted of shipments of siliceous gold ore and oxidized lead ore from the Tombstone group of the Bunker Hill Mines Co., which as usual was operated by lessees. The output represented a decided decrease from that in 1929, and only about 240 feet of development were done in this extensive property in 1930. The lead occurs as carbonate and the silver as chloride; the gold is native. The property is owned by the Phelps Dodge Corporation, which gave the following paragraphs in its printed annual report for 1930 regarding the Tombstone group:

> Leasing operations were continued throughout the year, but on a curtailed basis due to the unsatisfactory price of silver and lead. A total of 5,570 tons of ore was shipped, of which 5,361 tons of siliceous ore went to the Douglas smelter and 209 tons of silver-lead ore to the El Paso smelter. The majority of the siliceous ore came from the Head Center-Contention area and contained a high percentage of gold. As a result the ore showed an increase in the gold but a decrease in the silver and lead.

> Development work was held to a minimum during the year, and only 240 feet of drifting and raising was done compared to 800 feet the year before. No new ore was discovered. The number of active leases averaged eight, compared to 20 in the previous year. * * *

From March to the end of December the Tombstone Mining Co. operated the Tombstone Extension property 2 miles east of Tombstone and shipped 58 cars of oxidized lead ore containing gold and silver. The mine is opened by a vertical shaft 250 feet deep and by various drifts, crosscuts, and raises. In 1930 the company did 243 feet of sinking, 793 feet of drifting, 338 feet of raises, 117 feet of crosscuts, and 51 feet of winzes. The company ranked third as a producer of lead in Arizona in 1930; the material mined was siliceous lead ore containing considerable iron. The Bob Ingersoll property, opened by an inclined shaft 700 feet deep, was operated by lessees who shipped nearly 400 tons of oxidized lead ore for smelting and did about 300 feet of development in 1930. No old tailings from the Grand Central dumps were treated in 1930.

Turquoise district (*Courtland*, *Pearce*, *Gleeson*).—Seven lode mines in the Turquoise district produced 5,303 tons of ore and old tailings yielding $8,659 in gold, 30,677 ounces of silver, 316,526 pounds of copper, and 24,870 pounds of lead, valued in all at $62,862, or $11.85 in metals a ton. The output in 1930 represents a decided decrease from 12,372 tons of ore and old tailings yielding metals valued at $172,801 in 1929. The largest producer was the Commonwealth mine operated by the Commonwealth Mining & Milling Co.; the production consisted of more than 1,700 tons of highly siliceous ore containing gold and silver, and the company shipped nearly 500 tons of siliceous old tailings for fluxing. The Black Diamond Copper Co. operated the Black Diamond property at Pearce four months of the year, did 200 feet of development, and shipped more than 1,200 tons of sulphide copper ore containing silver and gold. Oxidized copper ore was shipped from the Costello group by the Mona Leasing Co., and oxidized copper ore and lead ore were shipped from the Tom Scott & Tejon property which was worked by a lessee. Only two cars of oxidized copper ore were shipped from the Germania & Maid of Sunshine property, formerly a large producer, owned by the Calumet and Arizona Mining Co. The Mystery mine at Gleeson produced 300 tons of low-grade silver ore; and the Great Western group, which was under lease, produced more than 700 tons of oxidized copper ore for smelting.

Warren district (*Bisbee*, *Lowell*, *Warren*, *Don Luis*).—Seven lode mines in the Warren district produced 1,978,297 tons of ore yielding $948,961 in gold, 1,701,858 ounces of silver, 127,899,718 pounds of copper, and 302,856 pounds of lead, valued in all at $18,246,282, or $9.22 in metals a ton. In 1929 six lode mines and one old slag dump produced 2,796,419 tons of ore and old slag yielding $1,410,350 in gold, 2,264,408 ounces of silver, 186,130,352 pounds of copper, and 2,040,899 pounds of lead, valued in all at $35,504,798; the ore was valued at $11.90 in metals a ton. The decrease of more than 58,230,000 pounds in copper resulted from the general curtailment in the district. The output of the district in 1930 consisted of 888,387 tons of first-class smelting ore, and of 1,809,910 tons of milling ore which were reduced to 152,314 tons of concentrates. The output included considerable copper and a little silver from mine-water precipitates and from heap leaching.

The Copper Queen branch of the Phelps Dodge Corporation at Bisbee was worked continuously and ranked first as a producer of copper in Arizona in 1930, fourth as a producer of gold and silver, and eighth as a producer of lead. The output of copper decreased nearly 35 per cent, gold more than 43 per cent, and silver nearly 30 per cent. The output of lead, relatively unimportant, decreased nearly 90 per cent from that in 1929. According to the report of the corporation for 1930 development consisted of 39,924 feet of work in drifts, raises, shafts, and miscellaneous openings. The corporation also did 12,018 feet of diamond drilling and 29,141 feet of churn drilling. Copper ore, concentrates, and precipitates as well as custom material were treated at the company's 2,300-ton copper smelter at Douglas. The copper concentrator treated 1,089,910 tons of ore averaging 1.84 per cent copper, compared with 1,445,425 tons averaging 2.15 per cent copper in 1929. The ratio of concentration was changed from 6.58 tons to 1 in 1929 to 7.13 tons to 1 in 1930. The recovery of total copper in concentrates was 89.25 per cent, compared with 91.32 per cent in 1929. The copper smelter at Douglas treated 620,055 tons of ore, concentrates, and matte, which produced 19,787 ounces of gold, 844,626 ounces of silver, and 101,704,411 pounds of copper. The 150-ton flotation plant erected in 1927 for the treatment of lead ores was again idle in 1930, as a result of curtailment in the output of lead ores by custom shippers. The 200-ton lead blast furnace at Douglas was operated until April, when it was closed due to low metal prices and insufficient custom ore. The lead plant treated 14,212 tons of custom lead ore and concentrates, which produced 2,136 ounces of gold, 728,876 ounces of silver, 561,474 pounds of copper, and 5,198,702 pounds of lead (a decrease of nearly 60 per cent from the lead production in 1929). The company report continues:

Ore and metals contained in output of Copper Queen mines in 1930

Kind of material	Total (dry weight)	Gold	Silver	Copper	Lead	Manganese
Underground limestone:	*Short tons*	*Ounces*	*Ounces*	*Pounds*	*Pounds*	*Pounds*
Copper ore	279, 882	13, 301	305, 832	29, 105, 906		
Lead ore	979	27	3, 862	21, 947	233, 696	
Manganese ore	317					12, 620
West ore body (including Sacramento Hill)	605, 675	2, 645	54, 644	18, 739, 837		
East ore body	579, 022	3, 229	69, 039	24, 206, 740		
Precipitates	9, 421		289	12, 121, 491		
Total	1, 475, 296	19, 202	433, 666	84, 195, 921	233, 696	12, 620

The Phelps Dodge Corporation paid $5,911,342 in dividends from all property in 1930, compared with $5,750,000 in 1929. In April it was proposed that the property of the Calumet and Arizona Mining Co. be merged with that of the Phelps Dodge Corporation, but the actual consolidation was delayed until late in 1931. An article on mining[10] at Bisbee appeared in September, and leaching operations were described in an article[11] published in June. The history and work of the Copper Queen branch were reviewed[12] in October, and the smelting plant at Douglas was described in two articles,[13] published in June and August.

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[10] Young, G. J., Glory Hole Mining at Bisbee: Eng. and Min. Jour., vol. 130, Sept. 8, 1930, p. 232.

A detailed report[14] covering operations at the Copper Queen mill was published in January, 1931.

There was a large decrease in the production of gold, silver, and copper from the properties worked by the Calumet and Arizona Mining Co. at Lowell. The company ranked second as a producer of silver in Arizona in 1930, third as a producer of gold, and eighth as a producer of copper. The chief output was sulphide copper ore containing gold and silver. The company also produced oxidized copper ore in 1930 and a little lead ore. The copper ore from the various shafts of the property is not milled but is shipped to the 3,500-ton smelter at Douglas. The mines produced[15] 427,436 wet tons of ore averaging 5.17 per cent copper, compared with 597,497 wet tons averaging 5.09 per cent copper in 1929. The copper output of the mines at Bisbee was less than that in any year since 1926. The property is opened by extensive underground workings, and considerable work has been done by diamond drilling and churn drilling. In 1930 the company did 40,453 feet of drifting, 14,577 feet of raising, and 982 feet of shaft sinking.

During 1930 a total of 671,898 dry tons of ore and concentrates, consisting of 374,859 tons of ore from the mines at Lowell, Ariz., 67,566 tons of ore from the Eighty-Five branch at Valedon, N. Mex., 110,126 tons of concentrates and cement copper from the New Cornelia mine at Ajo, Ariz., and 119,347 tons of ore from custom shippers, was smelted at Douglas, Ariz. The output comprised 49,194.05 ounces of gold, 1,476,092 ounces of silver, and 88,839,719 pounds of blister copper, compared with 62,357.81 ounces of gold, 2,002,956 ounces of silver, and 130,486,607 pounds of blister copper in 1929.

Dividends amounting to $1,685,714 were distributed to stockholders in 1930 by the consolidated company, making a total of $75,489,160 paid since the organization of the original Calumet & Arizona Mining Co. in 1903. In 1929 dividends amounting to $7,285,563 were paid. The net income for 1930 was $1,230,749.

Mining methods at the Campbell mine were described in an article[16] that appeared in April and in another[17] published in October. At Douglas the new casting plant made anodes for the refinery of the Nichols Copper Co. at El Paso, Tex., and the smelter and acid plants[18] were active.

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[11] Simmons, O. E., Leaching and Cementation at the Copper Queen Branch of the Phelps Dodge Corporation: Min. Cong. Jour., June, 1930, p. 529.

[12] Pullen, J. B., History and Operations of the Copper Queen Branch of the Phelps Dodge Corporation: Min. Cong. Jour., October, 1930, p. 764.

[13] Mills, R. H., Flow Sheet of Copper Smelting, Douglas Reduction Works: Min. Cong. Jour., June, 1930, p. 532.
Fleming, R. C., Douglas Smelter: Min. and Met., August, 1930, p. 397.

[14] Wittenau, E., and Cramer, W. B., Milling Methods and Costs at the Copper Queen Concentrator of the Phelps Dodge Corporation, Bisbee, Ariz.: Inf. Circ. 6404, Bureau of Mines, 1931, 29 pp.

[15] Calumet and Arizona Mining Co. Ann. Rept. for 1930.

[16] Lavender, H. M., Mining Methods at the Campbell Mine of the Calumet and Arizona Mining Co., Warren, Ariz.: Inf. Circ. 6289, Bureau of Mines, 1930, 18 pp.

[17] Young, G. J., Shaft Concreting in Arizona: Eng. and Min. Jour., vol. 130, Oct. 9, 1930, p. 336.

[18] Jacks, N. E., Calumet and Arizona Mining Co. Sulphuric Acid Plant: Min. Cong. Jour. July, 1930, p. 615.

The Shattuck-Denn Mining Corporation operated the Shattuck mine, which was on a production basis until July 1 and closed entirely during October, November, and December. The Denn mine was productive until November 1, after which it was operated on a development basis. The 400-ton flotation mill at Don Luis, erected for the treatment of oxidized lead ore, was not used in 1930 and has been abandoned. The Denn mine is opened by a vertical shaft to a depth of 2,200 feet, and development in 1930 consisted of 8,978 feet of drifts and raises and 2,715 feet of diamond drilling. In the Shattuck mine, where the vertical shaft is 1,100 feet deep, the company did 3,802 feet of drifting and raising and 843 feet of diamond drilling. According to the last printed report [19] the company produced from both properties 9,948,220 pounds of copper and considerable gold and silver. The Shattuck mine produced ore shipments from prospecting small pockets and stringers, which yielded 968,160 pounds of copper and gold and silver valued at $2,543. The Denn mine produced, chiefly during the first three-quarters of the year, 76,219 tons of first-class copper ore; and the average recovery was 0.063 ounce of gold, 1.93 ounces of silver, and 5.89 per cent of copper. The average price received for copper was 15.95 cents a pound, and the net operating cost per pound of copper at the Denn mine (the chief producer) was 10.21 cents. Work at the Denn mine was described in an article [20] published in July.

The gross income of the corporation for 1930 was $1,485,390; the net income, after payment of various items for taxes, interest, mining, development, and refining and marketing of metals, but exclusive of provision for depletion and depreciation, was $123,780. The surplus on December 31, 1930, was $3,857,181.

Lessees operating part of the Night Hawk property did 900 feet of development in 1930 and shipped considerable copper ore to the Copper Queen smelter at Douglas. Part of the ore was shipped in the name of the Night Hawk Contract, but most of it was included in the report of the Copper Queen branch of the Phelps Dodge Corporation.

The Wolverine & Arizona Mining Co. operated its property near Don Luis, did 700 feet of development, and shipped nearly 2,600 tons of oxidized copper ore to Douglas for smelting. The company also had a lease on the Higgins property of the Phelps Dodge Corporation. In 1930 the leasing company did about 500 feet of development and shipped nearly 1,200 tons of copper ore, which were included in the report of the Copper Queen branch of the Phelps Dodge Corporation.

Yellowstone district (*Cascabel*).—A test sample of gold ore was shipped from the San Jose mine from Benson on the Southern Pacific Railroad.

COCONINO COUNTY

Francis district.—Two lode mines in the Francis district produced oxidized copper ore of smelting grade. One car of oxidized copper ore was shipped by lessees from a prospect near Apex on the Atchison,

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[19] Shattuck-Denn Mining Corporation Ann. Rept. for 1930.

[20] Bronson, C. E., and Wilcox, J. A., History and Development of the Denn Mine: Min. Cong. Jour., July, 1930, p. 617.

Topeka & Santa Fe Railway, and a sample of similar material was shipped from the Anita & Emerald property where only assessment work was done.

GILA COUNTY

Operators of 25 lode mines in Gila County reported 9,965,806 tons of ore sold or treated in 1930, compared with 11,439,598 tons in 1929. Gold decreased from $149,588 to $122,868, silver from 327,502 to 219,998 fine ounces, copper from 196,789,955 to 165,776,725 pounds, and lead from 5,951,967 to 1,906,290 pounds. No zinc was produced in 1929 or 1930. Gila County ranked first in the State in value of metal output, with an output of nearly 29 per cent of the total copper and more than 22 per cent of the total lead produced. The decrease in total value of the four metals from $35,334,152 in 1929 to $21,853,856 in 1930 was due to the marked curtailment from mines near Globe and Miami. Nearly all—9,959,546 tons—of the output from the county was classified as copper material, of which 7,197,147 tons were concentrated; the resulting concentrates—163,041 tons—yielded 5,253.14 ounces of gold, 177,829 ounces of silver, and 101,528,617 pounds of copper. The larger part of the copper material was treated at concentrating or leaching plants near Miami; but some was treated at smelters at Hayden, Douglas, and Superior, Ariz., and El Paso, Tex. The lead ore from the county was chiefly oxidized material shipped to smelters at Douglas, Ariz., or El Paso, Tex. The remainder of the county output was siliceous ore, chiefly gold ore of smelting grade.

Banner district.—Five lode mines in the Banner district (Gila County) produced a total of 223,848 tons of ore yielding $30,790 in gold, 75,565 ounces of silver, 7,550,488 pounds of copper, and 1,857,598 pounds of lead, valued in all at $1,134,325, or $5.07 in metals a ton. The output decreased considerably from that in 1929, when mines in the district produced 144,346 tons of ore yielding $33,072 in gold, 107,499 ounces of silver, 5,039,983 pounds of copper, and 5,876,861 pounds of lead, valued in all at $1,347,648, or $9.34 in metals a ton. The largest producer in the district was the Christmas Copper Co. (controlled by the Iron Cap Copper Co.), operating property on the Gila River 6 miles north of Winkelman. The mine and mill were operated continuously in 1930, and the output of copper was nearly doubled as the new mill was active 12 months in 1930 instead of 6 months, as in 1929. The company reported[21] a production of 182,241 tons of mill ore containing 2.036 per cent copper, treated in the flotation plant at a cost of 66 cents a ton. The resulting concentrates, together with 34,363 tons of crude smelting ore containing 2.083 per cent of copper, were shipped to Hayden for smelting. The Iron Cap Copper Co. reported the production of 6,924,735 pounds of copper, 33,806 ounces of silver, and 1,007 ounces of gold from the Christmas mine; the copper was sold at an average price of 12.675 cents a pound. The property is opened by one shaft 830 feet deep, another 495 feet deep, and other workings aggregating 20,383 feet. The company did 7,990 feet of development in 1930. Improvements at the mine consisted of a new hoist and compressor, a new hoist house, and an addition to the power house. The recovery in the new milling plant was reduced from 87 57 per cent of the copper in the feed in 1929 to 80.52 per cent in 1930, but the cost of milling was reduced from 89 cents a ton in 1929 to 66 cents a ton in 1930.

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[21] Iron Cap Copper Co. Ann. Rept. for 1930.

The Iron Cap Copper Co., which owns 75 per cent of the stock of the Christmas Copper Co., paid $18,616 in dividends in 1930, as in 1929. The original Iron Cap property at Globe was idle.

The 79 mine 4 miles north of Hayden Junction was productive from January to June. It was under development in July and August, and long-hole drilling work was done in September and October, after which the mine was closed. During the first half of the year the company shipped more than 1,700 tons of copper ore for smelting and 5,400 tons of first-class silver-lead ore. Development during the same period consisted of 4,105 feet in drifts, crosscuts, and raises. The mine ranked second as a producer of lead in Arizona in 1930. Two cars of siliceous gold ore from the Standard property 4 miles north of Hayden were shipped from Burns on the Southern Pacific Railroad. A car of gold ore was also shipped from the Columbia group of the Dripping Springs Mines Consolidated, which was under lease, and one car of oxidized lead ore was shipped from the Kuhlman property near Hayden Junction.

Globe district (*Miami*, *Inspiration*).—In 1930, 16 lode mines in the Globe district produced a total of 9,740,546 tons of ore yielding $90,471 in gold, 143,003 ounces of silver, 158,119.898 pounds of copper, and 32,836 pounds of lead, valued in all at $20,702,756, or $2.13 in metals a ton. Most of the ore (7,014,155 tons) was concentrated and yielded 151,300 tons of concentrates which, with 45,655 tons of crude ore, were shipped for smelting. Nearly all the copper concentrates and first-class copper ore went to a smelting plant in the district; but all the lead ore was shipped to El Paso, Tex., or to Douglas, Ariz. In 1929, 23 lode mines in the Globe district produced a total of 11,293,656 tons of ore yielding metals valued at $33,958,735.

The largest output in the district came from the Miami mine, which produced 6,124,993 tons of copper ore; the Inspiration mine was second, with 3,054,030 tons; and considerable ore was also mined at the Old Dominion, Arizona Commercial, and Van Dyke mines.

From the Inspiration property [22] a total of 65,606,664 pounds of copper was produced during 1930, consisting of 7,162,460 pounds from concentrating operations, 58,442,419 pounds from leaching, and 1,785 pounds from direct smelting. Compared with 1929 the output of copper decreased 41,700,403 pounds, chiefly from ore concentrated, as the flotation plant was idle 7 months. The property ranked fourth as a producer of copper in Arizona in 1930. The total ore mined and treated averaged 1.224 per cent of copper; the concentrating and smelting ores averaged 1.115 per cent and the leaching ores 1.241 per cent. The copper produced in 1930 was recovered from the treatment of 3,054,030 tons of ore, including 8,092 tons of Inspiration concentrating ore, 365,085 tons of Live Oak concentrating ore, 830,316 tons of Inspiration leaching ore, 1,850,418 tons of Live Oak leaching ore, and 119 tons of Live Oak ore of smelting grade. A report[23] describing in detail the mining methods used at Inspiration was published in September, 1929. The chief operation of the year, as the flotation concentrator was active on sulphide ore only during the first five months of 1930, was that of the original leaching plant, which is equipped with large vats for percolation leaching and a tank house for the electrolytic deposition of copper. As the recovery of copper was only 80.57 per cent in the leaching plant under the original practice, on account of difficulties with the slime and the presence of considerable copper in sulphide minerals, a new slime-treatment plant was completed and placed in operation in May, 1930. In the new slime-leaching plant the feed is treated in Dorr agitators and thickeners, and the copper is precipitated from solution by scrap iron. Under the new scheme the ore for the leaching plant is crushed to one-fourth inch and is separated into a sand product and a slime product in Dorr bowl classifiers. The sand product goes directly to the leaching vats; and the slime product from the classifiers goes directly to the flotation plant, which makes copper concentrate and tailings that are thickened and pumped to the new slime-leaching plant. The flow sheet of the revised plant, the details of operation, and the results by months at these interlocking plants are given in an article[24] published in April, 1931. The cost of fine copper produced, including depreciation but excluding depletion and Federal taxes, amounted to 9.6671 cents a pound. Dividends paid during 1930 amounted to $2,954,918, making a total of $53,167,304 paid to the end of 1930. Development in 1930 consisted of 2,500 feet of haulage drifts, 28,493 feet in small drifts, 35,911 feet in main raises, 1,287 feet in finger raises, and 95 feet in shaft sinking. The company also took out about 2,997 cubic yards of material in miscellaneous excavations. An article[25] describing mining and development at the property was published in October. The mine and the original leaching plant, which has a daily capacity of 9,000 tons, were operated the entire year, but the 18,000-ton flotation mill was operated only five months on sulphide ore. One section of the concentrator operated from May until the end of the year on slimes from ore crushed for the leaching plant. The net income for the year ended December 31, 1930, was $273,759; the surplus, after dividends paid in 1930 were deducted, was $8,160,933.

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[22] Inspiration Consolidated Copper Co. Ann. Rept. for 1930.

According to its annual printed report the Miami Copper Co. produced 67,124,596 pounds of refined copper from 6,124,993 tons of milling ore at a cost of 10.878 cents a pound. This output was more than 8,283,000 pounds greater than that in 1929. The mine and mill were operated continuously, and the property ranked third as a producer of copper in Arizona in 1930. The concentrator operated 357 days, treating an average of 17,141 tons of ore a day for the period. The ore treated contained on the average 0.716 per cent copper, of which 0.604 per cent was sulphide, compared with 0.685 per cent in 1929. The property has in reserve 84,276,787 tons of sulphide ore averaging 0.88 per cent copper and 7,000,000 tons of mixed ore averaging 1.83 per cent copper. Development in 1930 consisted of 11,466 feet of drifts, crosscuts, and stations. 20,087 feet of raises, and 869 feet of shaft sinking, a total of 32,422 feet. From 6,124,993 tons of ore milled 101,388 tons of concentrates were produced, averaging 34.127 per cent copper, a recovery of 78.88 per cent of the total copper. The ratio of concentration was 60.41 tons to 1. Dividends amounting to $1,774,400 were paid to stockholders in 1930, making a total of $37,332,623 paid since May 15, 1912. The operating profit for 1930 was $1,123,687, and the surplus after dividends were paid was $8,709,056.

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[23] Stoddard, A. C., Mining Practice and Methods at Inspiration Consolidated Copper Co., Inspiration, Ariz.: Inf. Circ. 6169, Bureau of Mines, 1929, 23 pp.

[24] Scott, W. G., Slime Leaching Plant at Inspiration: Min. Jour. (Ariz.), Apr. 15, 1931, p. 7.

[25] Stoddard, A. C., Development and Mining at Inspiration: Min. Cong. Jour., October, 1930, p. 758.

The Old Dominion Co. at Globe operated its mine and 1,700-ton flotation plant the entire year and shipped copper ore and concentrates to the International smelting plant at Miami. According to the annual report of the company for 1930 a total of 470,327 dry tons of smelting and concentrating ore was mined, averaging 2.27 per cent copper. The refined copper produced from this ore was 17,596,795 pounds, compared with 18,943,441 pounds in 1929. The concentrates averaged 26.05 per cent copper, the extraction was 89.31 per cent, and the ratio of concentration was 12.76 tons to 1. The company ranked tenth as a producer of gold in Arizona in 1930, eleventh in copper, and thirteenth in silver. Dividends amounting to $14,405,260 were paid to stockholders from December 15, 1905, to December 31, 1918, but no disbursements were made in 1930. The total income for the year was $3,133,329; the expenses, including depreciation, amounted to $4,021,153; and the loss, before depletion, was $887,824. The surplus on December 31, 1930, after depletion was deducted, was $29,573. The property was worked to a depth of 2,316 feet; development totaling 27,590 feet was done in 1930. The Old Dominion Co. purchased the adjoining Arizona Commercial mine early in 1931. A detailed report[26] describing mining methods at the Old Dominion mine was published in February. A report[27] on the operations of the Old Dominion mill was published in 1931.

The Arizona Commercial Mining Co. worked its mine 11 months of the year, but owing to depletion of the ore reserves the property was closed in December. Crude smelting ore was shipped to Miami and sulphide copper ore of milling grade to the Old Dominion flotation plant; the resulting copper concentrates were shipped, as formerly, with the Old Dominion product to Miami for smelting. According to the annual printed report of the company the total output of milling ore amounted to 58,709 tons averaging 3.40 per cent copper and 6,161 tons of siliceous smelting ore averaging 2.40 per cent copper. The company was paid for 3,644,877 pounds of copper, 18,042 ounces of silver, and 474 ounces of gold. The sales of refined copper amounted to 846,321 pounds, which sold for an average price of 14.79 cents a pound. Expenditures for mining, treatment, and refining were $188,004; selling, general, and administration costs were $20,358; and depreciation was $39,642. The total dividends paid since October 31, 1916, including $66,250 paid in 1930, amounted to $2,544,000. The total income for 1930 was $161,070; after $248,004 was paid for expenses the net loss before depletion was $86,934. No development was done in 1930. The annual report states:

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[26] Shoemaker, A. H., Mining Methods at the Old Dominion Mine, Globe, Ariz.: Inf. Circ. 6237, Bureau of Mines, 1930, 21 pp.

[27] Forrester, D. L., and Cramer, W. B., Milling Methods and Costs at the Concentrator of the Old Dominion Co., Globe, Ariz.: Inf. Circ. 6467, Bureau of Mines, 1931, 30 pp.

> On account of exhaustion of ore, operations at the mine ceased in December, 1930. The mine and equipment were sold to the Old Dominion Co. for $20,000 cash. In February, 1931, the stockholders voted to liquidate and a first distribution in liquidation of $1 a share was paid February 28, 1931.

The Van Dyke Copper Co. operated the Van Dyke property near Miami and shipped nearly 20,000 tons of oxidized copper ore to the International smelter near Miami and the Copper Queen plant near Douglas. The mine is opened to a depth of 1,550 feet, and in 1930 the company did 3,335 feet of drifting and crosscutting and 831 feet of raising. Considerable development was done at the Bronze King, Pinto Valley, and Rescue groups in the vicinity of Globe and the Defiance group north of Globe, which in the past marketed ore containing gold, silver, copper, lead, and vanadium. The operators did 195 feet of drifting on the 150-foot level at the Defiance mine in 1930. The Porphyry Reserve Copper Co., which owns the Gila Monster group, produced more than 3,000 tons of oxidized copper ore which was marketed chiefly through the work of lessees. The company did 2,605 feet of diamond drilling, but development was suspended in April. The remainder of the ore from the Globe district consisted of nearly 2,000 tons of dump ore from property belonging to the Inspiration Consolidated Copper Co., shipped by lessees, and miscellaneous shipments of copper ore from the High Line, Bird, Silver Lake, and Superior & Boston properties; oxidized lead ore from the Mallory and Old Red mines; two cars of siliceous gold ore from the Savage mine; and one car of gold ore from the Wright mine.

Green Valley district.—The mines of the Green Valley district were not operated in 1930, and no products were marketed except a small test lot of gold bullion from the Gold Bond property.

Pioneer district.—No output was reported from the Pioneer district (Gila County) in 1930, but the Bobtail group was under development by the Western Mines Syndicate (Inc.) which did 200 feet of drifting on the 200-foot level.

Summit district.—Except for a small lot of copper ore from the Penn & Leach claims the output of the Summit district consisted of ore and concentrates from the Gibson group of the Bellevue Copper Co. The property is equipped with a 25-ton table concentrator.

Young district.—The Spring Creek Leasing Co. operated the Spring Creek property near Young and treated more than 500 tons of lead ore in a 50-ton gravity concentration plant. The chief ore minerals were galena, cerussite, and argentite; the concentrates yielded on the average nearly 2 ounces of gold to the ton, in addition to silver and lead.

GRAHAM COUNTY

One placer and five lode mines in Graham County produced 2,836 tons of ore, $1,242 in gold, 24,290 ounces of silver, 66,571 pounds of copper, and 759,781 pounds of lead, valued in all at $57,237, compared with $23,969 from five lode mines in 1929. Most of the output was first-class oxidized lead ore from the Grand Reef mine 3 miles north of Klondyke.

Aravaipa district.—Four lode mines in the Aravaipa district produced 2,834 tons of ore yielding $1,162 in gold, 24,290 ounces of silver, 66,571 pounds of copper, and 759,781 pounds of lead, valued in all at $57,157, or $20.17 in metals a ton. Most of the output was oxidized lead ore from the Grand Reef mine north of Klondyke, which produced more than 2,700 tons of oxidized silver-lead ore that were shipped to El Paso from Cork on the Southern Pacific Railroad. Lead ore was also shipped from the Bullis-Landsman group, the Lee property, and the Rabal group.

Lone Star district.—A small test lot of gold ore from the Shenandoah property was the only shipment from the Lone Star district in 1930.

GREENLEE COUNTY

The total value of the metal output in Greenlee County decreased from $10,199,579 in 1929 to $5,720,971 in 1930. The output was chiefly copper ore from the Morenci property of the Phelps Dodge Corporation. The output of copper decreased 24 per cent (13,950,623 pounds); the value of the total output of metals decreased 44 per cent, on account of the lower metal prices and the general curtailment at the mines and smelter at Morenci and Clifton.

Copper Mountain and Greenlee districts (*Morenci*, *Metcalf*, *Clifton*).—The output of the Copper Mountain and Greenlee district was chiefly copper ore from the Morenci property of the Phelps Dodge Corporation. The company operated its mine, the 5,500-ton gravity and flotation plant at Morenci, and its smelter at Clifton on a 5-day basis. The concentrator treated 1,346,233 tons of ore, which yielded 114,563 tons of copper concentrates. The Clifton smelter treated a total of 137,748 tons of copper material (including the above concentrates), which yielded 2,309 ounces of gold, 50,516 ounces of silver, and 42,618,265 pounds of copper (18,487,260 pounds as ingots and 24,131,005 pounds as blister copper). The output of copper was nearly 23 per cent less in 1930 than in 1929, and the property ranked sixth in production of copper in Arizona in 1930 and ninth in gold and silver. In addition to the ore milled shipment of several thousand tons of ore was made direct to the smelter at Clifton.

Development amounting to more than 31,627 feet was done in 1930, including 3,493 feet of raises for ore extraction on the lower lift; also, 2,180 feet of diamond drilling were done in the Humboldt section. The report of the Phelps Dodge Corporation continues:

> * * * Sinking of No. 6 ore hoisting shaft, excavation of one main pocket and all spill pockets were completed, and the shaft is operating very satisfactorily with the new hoist, headframe, and 7-ton skips. Two underground service shafts to accommodate lower lift levels were driven, and the old Ryerson shaft stripped and made a ventilation shaft for the lower lift.
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> The concentrator treated 1,346,233 dry tons of ore, from which was produced 114,563 tons of concentrates. The work of remodeling the coarse crusher plant and the concentrator for increased capacity of 5,000 tons per day was completed, and results indicate that the new equipment will treat the estimated tonnage with improved costs and metallurgy.
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> The average monthly tonnage treated by the Clifton smelter amounted to 11,479 tons of new metal-bearing material. One reverberatory furnace oper-

ated throughout the year with but one major repair. The making of anodes was discontinued. Excellent progress was made in improving equipment and technique for maintaining a uniformly high grade of fire-refined copper sold as ingots.

Construction of the milling and leaching pilot plant to test ore from the Clay ore body was completed. The two plants were erected side by side, and during 1931 representative tests will be run taking the same feed of representative low-grade ore. Additional diamond drilling was done during the year so as to establish more definitely the outline of the low-grade ore body. A great deal of engineering work was done during the year under the supervision of Mr. C. Legrand in developing the different problems in connection with handling and treating the ore.

An interesting group of four articles[28] describing the history of the Morenci district, the Morenci mine, the Morenci concentrator, and the Clifton smelter, was published in June, 1929.

Besides these articles two reports[29] published by the Bureau of Mines describe the mining and milling methods and costs at Morenci.

The output from the property of the Dover Copper Mining Co. 7 miles west of Morenci was less than half of that in 1929. The company, however, shipped to El Paso, Tex., for smelting more than 1,100 tons of oxidized copper ore, most of which was mined before the property was closed late in April. The company reports having spent nearly $25,000 in development of the mine, which is opened chiefly by a 500-foot tunnel, 600 feet of raises, and 160 feet of crosscuts. The Eagle Gold & Copper claims near Clifton were not operated vigorously, but one car of copper ore was shipped by a lessee. The United States Copper Mining Co. operated the Detroit group, and although it shipped no ore it did 365 feet of diamond drilling and cleaned out 600 feet of the Kentucky tunnel.

San Francisco River district.—A little placer gold and silver valued at $159 was recovered from bench gravel by drifting on the banks of the San Francisco River. The output was divided between the Frisco placer near Morenci and the Graham placer on Chase Creek.

MARICOPA COUNTY

Twenty lode mines in Maricopa County produced 3,647 tons of ore and old tailings, a decrease of 14,706 tons from the output of 15 mines in 1929. Of the total ore, etc., 663 tons were ore concentrated and yielded 150 tons of concentrates having a total value in metals of $20,595. The ore and old tailings treated by amalgamation or cyanidation amounted to 37 tons and yielded gold and silver valued together at $454. The first-class smelting ore amounted to 2,947 tons and yielded metals valued at $62,763. Placer bullion valued at $249 was reported by three operators. The total value of the metal output decreased from $221,965 in 1929 to $84,061 in 1930.

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[28] Robinson, G. M., A Brief History of the Clifton-Morenci District: Min. Cong. Jour., June, 1929, p. 436.

Mosier, McHenry, and Sherman, Gerald, Mining Practice at Morenci Branch, Phelps Dodge Corporation, Morenci, Ariz.: Min. Cong. Jour., June, 1929, p. 439.

Crowfoot, Arthur, and Barnard, D. C., Concentrator of the Phelps Dodge Corporation, Morenci Branch: Min. Cong. Jour., June, 1929, p. 448.

Simcox, I. J., The Clifton Smelter of the Phelps Dodge Corporation: Min. Cong. Jour., June, 1929, p. 455.

[29] Mosier, McHenry, and Sherman, Gerald, Mining Practice at Morenci Branch, Phelps Dodge Corporation, Morenci, Ariz.: Inf. Circ. 6107, Bureau of Mines, 1929, 34 pp.

Crowfoot, Arthur, Concentrating Methods and Costs at the Morenci Concentrator of the Phelps Dodge Corporation, Morenci, Greenlee County, Ariz.: Inf. Circ. 6460, Bureau of Mines, 1931, 36 pp.

Agua Fria district.—No gold was marketed from the Agua Fria district in 1930, but development was continued at the old Relief mine by the Sunrise Relief Mines (Inc.). The property is opened by an inclined shaft and about 1,200 feet of work in drifts and crosscuts and was formerly a producer of gold of exceptional fineness.

Big Horn district.—The output of the Big Horn district consisted of one car of oxidized copper ore, containing considerable gold, from the Powell property and two cars of similar material from the Hauxhurst property 20 miles south of Aguila, a station on the Atchison, Topeka & Santa Fe Railway.

Cave Creek district.—Three lode mines in the Cave Creek district produced 1,055 tons of ore yielding $6,462 in gold, 1,793 ounces of silver, and 54,724 pounds of copper, valued in all at $14,266, or $13.52 in metals a ton. The chief production was that of the Mormon Girl property 1½ miles southeast of Cavecreek, which produced more than 1,000 tons of highly siliceous oxidized copper ore containing considerable gold. The mine is opened by a 500-foot inclined shaft, a tunnel 500 feet long, and 600 feet of drifts; in 1930 the company did 100 feet of development. One car of oxidized copper ore was shipped from the Mexican Hill property of the Missouri Copper Co. (Inc.), and a small lot of low-grade material was marketed from the MacLane prospect.

Magazine district.—The Red Rover property was in the hands of lessees who shipped nearly 1,700 tons of oxidized copper ore containing considerable silver. The output represents an increase from 500 tons produced in 1929, but no report regarding production or development was made by either the operator or the company.

San Domingo district.—A small quantity of placer gold was mined from the San Domingo Wash near Hot Springs.

Sand Tanks district.—A small lot of oxidized copper ore was marketed from the New Maricopa property near Gila Bend.

Sunset district.—Gold bullion from the Rush claim and other prospects near Aguila was sent to the San Francisco Mint.

Vulture district.—Two placers and four lode mines in the Vulture district produced 727 tons of ore, $7,101 in gold, 5,546 ounces of silver, 35,710 pounds of copper, and 172,243 pounds of lead, valued in all at $22,490. The ore had an average value of $30.94 in metals a ton. In 1929, when the Belmont-MacNeill property near Palo Verde was active, the value of the district metal output was $186,821.

Early in 1930 the plant of the Belmont-MacNeill property of the Tonopah Belmont Development Co. was sold and dismantled. Mining operations ceased in January, and the mill treated only 663 tons of copper-lead ore. Concentrates containing gold, silver, copper, and lead were shipped to El Paso, Tex. In the past five years a total of 55,420 tons of copper-lead ore from this property has been mined and treated.

Two cars of oxidized copper ore were shipped from the Owl group 9 miles southwest of Wickenburg, a test lot of oxidized lead ore was shipped from the Lead Nuggett property, and small test lots of rich gold ore were shipped from prospects near Wickenburg. The Vulture property, a famous producer in the past, was prospected by the Vulture Mining & Milling Co. The company did considerable work in diamond drilling and started a vertical shaft to tap the ore body indicated. Considerable development was also done at the Black Bird mine of the Tiger Mines (Inc.), and a little placer gold was recovered at the Florence placer and other claims near Wickenburg.

White Picacho district.—One car of oxidized copper ore was shipped from the Combination property 10 miles east of Morristown, a test lot of silver-copper ore from the Swan Nilson group, and a sample of silver ore from the Texas Ranger property at the head of San Domingo Wash.

Winifred district.—Four lode mines in the Winifred district produced 66 tons of ore and old tailings yielding $802 in gold, 7 ounces of silver, and 1,170 pounds of copper, valued in all at $957, or $14.50 in metals a ton. One car of oxidized copper ore was shipped from the Postmaster mine 9 miles north of Phoenix, a test lot of gold ore from the Rodgers claim, and gold bullion and ore from the Eyrich property. A sample of gold ore containing a little copper was also marketed from the Bob Cats claim.

MOHAVE COUNTY

In Mohave County 20 lode mines and 2 old tailings dumps produced 29,835 tons of ore, old tailings, etc., an increase of 19,266 tons over the output of 40 mines and 4 dumps in 1929. Three placers also were productive in 1930. The total output of gold increased from $147,682 to $594,011; the output of silver decreased from 33,429 to 25,942 fine ounces, copper from 24,926 to 2,617 pounds, lead from 161,417 to 37,640 pounds, and zinc from 133,414 to 35,104 pounds. The total value of the five metals increased from $188,861 to $607,906. The notable increase in the output of gold was due almost entirely to the large production of the Tom Reed property at Oatman. The ore treated in the county by amalgamation or cyanidation, mainly the latter, amounted to 24,047 tons which, with 5,432 tons of old tailings, yielded $588,734 in gold and 21,652 ounces of silver, valued together at $597,070; the ore and old tailings averaged $20.25 in metals a ton. The concentrating ores and old tailings (301 tons) yielded 111 tons of concentrates which had a total value in metals of $7,382, or an average of $66.50 a ton. Crude ore shipped to smelters amounted to 51 tons and had a total value in metals of $2,347, or an average of $46.02 a ton. The Tom Reed property was by far the most important producer in the county; the output from the Katherine mine was small.

Chemehuevis district.—A little gold ore from the Gold Wing property was treated by amalgamation, and the resulting bullion was sold in San Francisco. A little placer gold was also marketed from surface deposits south of Yucca. The Dutch Flat property, which is equipped with a 10-ton Gibson mill, was being developed; work totaling 200 feet was done in the tunnel, which is 400 feet long.

Colorado River district.—A little placer gold was recovered from property belonging to the Arizona Dredging Co. 70 miles north of Kingman on the Colorado River.

Cottonwood district.—The Walkover property 9 miles southeast of Hackberry was idle in 1930, but a little clean-up material containing chiefly gold was shipped to El Paso, Tex. Some placer gold from claims near Hackberry was sent to the San Francisco Mint.

Greenwood district.—A little drifting was done at the Bonanza group 2 miles from Burro Creek, and a test lot of gold ore for smelting and a little bullion resulting from the operations of an arrastre were shipped from the property.

Indian Secret district.—The White Hills Silver Mines (Inc.) produced a little silver ore from its property north of Kingman in 1929 but did only development (300 feet) in 1930.

Maynard district.—A small amount of gold ore from the Smith prospect was treated by amalgamation, and the bullion was deposited at the San Francisco Mint.

Music Mountain district.—No output was reported from the Music Mountain district in 1930, but considerable development was done at the Portland & Mizpah property 23 miles north of Hackberry. During the year a 30-ton Hendy rod mill and equipment for amalgamation and cyanidation were installed at the property.

Owens (*McCracken and Potts Mountain*) *district.*—The Senator & McCracken property near Signal, a former producer of silver-lead ore treated by concentration, was idle in 1930.

Pilgrim district.—The Pilgrim mine west of Chloride was operated under the management of the United Pilgrim Mines (Inc.) after November 15 but was not productive in 1930. The property is equipped with a 25-ton amalgamation mill for the treatment of gold ore and is opened by 800 feet of underground work.

San Francisco district (*Oatman*, *Gold Road*, *Vivian*).—Eleven lode mines in the San Francisco district produced 28,048 tons of ore and old tailings yielding $580,768 in gold and 18,274 ounces of silver, valued together at $587,803, or $20.96 a ton. The Tom Reed Gold Mines Co. operated its mine and mill at Oatman uninterruptedly, treating ore partly from mines in the vicinity but chiefly from the Tom Reed property. The mill is a 250-ton all-slime cyanidation plant, and the ore contains chiefly gold. More than $42,000 worth of gold bullion per month (other than that recovered from custom material) was shipped to the San Francisco Mint from the Tom Reed property. The property is opened to a depth of 1,100 feet by a vertical shaft, and the company did 2,162 feet of development in 1930. The property ranked second as a producer of gold in Arizona in 1930 and greatly increased its output over that in 1929, when the mill treated only 4,430 tons of gold ore from the district. No dividends were paid in 1930, but $3,094,215 has been paid in the past. Considerable gold ore, averaging about $20 in gold to the ton, was mined from the United American property and treated at the Tom Reed mill. Early in the year lessees at the Gold Road property, a large producer of gold in the past, treated 4,000 tons of old tailings and 650 tons of ore yielding gold bullion valued at nearly $9,500. The Pioneer group of the Pioneer Consolidated Mines Co., 33 miles north of Kingman, was operated continuously in 1930 and produced gold and silver valued at about $7,100. Most (about 400 tons) of the ore was treated locally in an amalgamation plant, and the remainder was sent to the Tom Reed mill for treatment by cyanidation. The mine is opened to a depth of 400 feet by a vertical shaft and various laterals, but no development was done in 1930. Other lots of bullion or crude ore were marketed from the Gold Center, Loftus (Orphan), Telluride, Times, and Vivian properties. At the Big Jim property the main shaft was retimbered from the surface to the 500-foot level, and a diamond-drilling campaign was started.

Union Pass district.—The Katherine Gold Mining Co., which operated property 33 miles west of Kingman, was under the management of a trustee in bankruptcy in 1930. Some rich gold ore was produced by a lessee, and gold bullion valued at nearly $9,400 was recovered from the old tailings dump.

Wallapai district (Cerbat, Chloride, Kingman, Mineral Park, Stockton Hill).—Five lode mines in the Wallapai district produced 342 tons of ore and old mill clean-up material yielding $2,130 in gold, 4,181 ounces of silver, 2,411 pounds of copper, 37,640 pounds of lead, and 35,104 pounds of zinc, valued in all at $7,620, or $22.28 in metals a ton. Of this output 43 tons were first-class smelting ore, 297 tons were concentrating ore, and 2 tons were old mill clean-up material shipped to a smelter. Comparatively little work was done in the Wallapai district in 1930, and the value of the output was less than one-third that in 1929. About 200 tons of lead-zinc ore from the Oro Plata group of the Copperconda Mines Co. were shipped to a custom flotation plant at Midvale, Utah; nearly 90 tons of similar material were shipped to Utah from the Hard Times group while assessment work was under way; one car of oxidized lead ore was marketed from the St. Louis group at Cerbat; and one car of siliceous gold and silver ore from the Tintic property near Chloride was shipped for smelting. Development was continued at the Silver Bell property of the Cornwall Mining Co. east of Keystone on the branch of the Atchison, Topeka & Santa Fe Railway from Kingman to Chloride. Work was also continued at the Horse Shoe property; a new 500-foot shaft was started, and tunnel work totaling 150 feet was done in 1930.

Weaver district.—A small test lot of oxidized copper ore, containing gold, from the Copper Hill property 22 miles northwest of Chloride was shipped for smelting through the Kingman sampler.

PIMA COUNTY

In Pima County the production of each of the metals was less in 1930 than in 1929, and the output of ore, etc., decreased from 3,617,735 to 2,375,974 tons. The output of copper decreased from 73,861,331 to 50,600,212 pounds and its value from $12,999,594 to $6,578,028. Gold decreased from $310,613 to $247,526, silver from 215,255 to 136,574 fine ounces, and lead from 817,004 to 545,735 pounds. The total value of the metal output decreased from $13,476,409 to $6,905,422. No zinc was produced in 1929 or 1930. The concentrating ores (1,909,959 tons) yielded 115,997 tons of concentrates—nearly all copper concentrates from Ajo—which had a total value in metals of $5,786,731. Ore of shipping grade aggregated 5,301 tons and yielded metals valued at $63,697. Many small lots of miscellaneous ore mined by operators from neighboring districts in Pima and Pinal Counties were handled through the Tucson Chamber of Mines and shipped in bulk to Hayden, Ariz., and El Paso, Tex. No ore originating in Pima County in 1930 was treated by amalgamation or cyanidation. The placer output amounted to $1,253 in gold and 10 ounces of silver.

Ajo district.—All the output of the Ajo district was from the New Cornelia property. The output of copper was 29 per cent less than in 1929, and the property ranked fifth as a producer of copper and gold in Arizona in 1930 and eighth as a producer of silver. According to a statement of the Calumet and Arizona Mining Co., which has controlled the property since April, 1929, the output of the property in 1930 was about 50,474,000 pounds of copper, 121,300 ounces of silver, and 11,444 ounces of gold from concentrates and from ore leached. The ore mined for concentration amounted to 1,916,932 dry tons and contained 47,539,914 pounds (an average of 1.24 per cent) of copper, of which 1.17 per cent occurred in sulphide form and the remainder in oxidized copper minerals. Of the sulphide ore mined the concentrator treated 1,906,955 dry tons, an average of 6,508 tons a day. Of the total ore mined 459,832 tons were carbonate ore leached at Ajo, containing 8,074,650 pounds (an average of 0.878 per cent) of copper. The soluble copper in the carbonate ore averaged 0.77 per cent and the insoluble copper 0.108 per cent. The leaching plant ceased operations July 2; the copper recovered from ore leached was about 8,000,000 pounds, compared with nearly 18,000,000 pounds in 1929. The ore reserves at the pit were said to have been increased in 1930, and the construction work at the mill was completed in November. The improvements at the property were described in two articles[30] published in June and July. A detailed report[31] on the operations of the New Cornelia leaching plant was also published in 1930. Dividends paid to stockholders of the New Cornelia Copper Co. from 1918 to February, 1929, amounted to $18,630,000. Since February, 1929, dividends paid from the profits of the New Cornelia mines have been included with those of the Calumet and Arizona Mining Co. Dividend payments, profit and loss statements, and mining and milling data are included in the printed report of the Calumet and Arizona Mining Co. for the year ended December 31, 1930. The company report continues:

> Seven diamond drill holes were completed during the year, totaling 6,868 feet of drilling.
>
> All units in connection with the concentrating plant are in good operating condition. All leaching plant units at this time are in proper condition for the resumption of operations.
>
> The additions to the concentrator, consisting of three units, with auxiliaries, changes in the crushing plant with additional bin capacity and complete screening installation, were completed. Not all of the new grinding and flotation units have been put into operation. The expected additional tonnages to be obtained in the crushing plant, with complete screening of material before delivery to the mill, have been greater than the estimates made.
>
> In the power plant the installation of a 7,500-kilowatt turbine with auxiliaries has been completed, and it is in satisfactory operation.

Amole district.—The output of the Amole district consisted of three cars of oxidized copper ore shipped from the Tucson group by the Southwestern Metal Mines (Inc.) and one car of copper ore and a small test lot of gold and silver ore from prospects southwest of Tucson.

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[30] Young, G. J., Improvements at New Cornelia I: Eng. and Min. Jour., vol. 129, June 30, 1930, p. 608; Improvements at New Cornelia II: Eng. and Min. Jour., vol. 130, July 10, 1930, p. 29.

[31] Bell, G. A., Leaching Practice and Costs at the New Cornelia Mines of the Calumet and Arizona Mining Co., Ajo, Ariz.: Inf. Circ. 6303, Bureau of Mines, 1930, 29 pp.

Arivaca district.—Four lode mines in the Arivaca district produced 14 tons of ore yielding metals valued at $489. Small lots of silver-lead ore were shipped from the Rosebud and Silver Crown properties, and some development in shaft sinking and drifting was done at the Rosebud property by the Amado Mining Co. The Mother Lode group, 26 miles from Amado, produced a little first-class copper ore and ore from which a sample lot of copper-lead concentrates was made. The Lincoln No. 1 prospect also produced a little lead ore, which was reduced to a test lot of lead concentrates containing considerable gold.

Baboquivari district.—Sample lots of siliceous gold ore were shipped from four prospects in the Baboquivari district, and the recovered metals were valued at $857. The output consisted chiefly of one lot of gold ore, containing some silver, from the property of the Arizona Jupiter Mines (Inc.) and a small lot of rich gold ore from the Jaeger mine.

Cababi district (*Comobabi*).—A test lot of oxidized lead ore containing considerable gold was shipped from a prospect near Sells. The Little Mary mine of the Como-Pima Mining Co. was idle in 1930.

Catalina district.—The Texas-Arizona Copper Co. operated the Pontotoc property 10 miles northeast of Tucson and did 50 feet of shaft sinking and 350 feet of 8-inch drill holes in prospecting the property.

Cerro Colorado district.—With the exception of a small lot of copper-lead ore and a small sample of gold ore from the Mary E. and Pesquiera prospects, no ore was shipped from the Cerro Colorado district in 1930. Silver ore amounting to several hundred tons was marketed from the Mary E. mine in 1929.

Empire district.—Five lode mines in the Empire district produced 356 tons of ore yielding $262 in gold, 2,243 ounces of silver, 6,804 pounds of copper, and 164,852 pounds of lead, valued in all at $10,254, or about $28.80 in metals a ton. In 1929 the district output consisted of 1,067 tons of ore from seven lode mines. All the output in 1930 was first-class smelting ore. The chief output came from the State of Maine group and consisted of 33 tons of oxidized copper-lead ore and 230 tons of oxidized lead ore produced by lessees. Oxidized lead ore was shipped from four other mines in the district—the Forty-Nine, Justice, Lead Carbonate, and Lone Mountain properties.

Greaterville district.—Three placers and one lode mine in the Greaterville district produced 34 tons of ore and metals valued at $1,883, a decrease from $7,887 from two placers and five lode mines in 1929. Lessees shipped a little siliceous ore containing chiefly gold and a little silver, copper, and lead from the Golden Gate property. The placer production from the district sold to storekeepers at Greaterville was valued at $1,257.

Helvetia district.—Three lode mines in the Helvetia district produced 2,258 tons of ore yielding $185 in gold, 1,282 ounces of silver, 145,882 pounds of copper, and 80 pounds of lead, valued in all at $19,648, or $8.70 in metals a ton. The output consisted of copper ore of smelting grade and old copper slag. The Narragansett Bay group at Rosemont 22 miles from Vail produced more than 800 tons of first-class copper ore, taken from surface workings. Several hundred tons of oxidized copper ore were shipped from the Forbes group, and several cars of sulphide copper material and nearly 800 tons of old slag were shipped from the Rosemont property.

Meyer district.—No ore was shipped from the Meyer district in 1930; the Gunsight property, formerly leased and operated by the Gunsight Mining Co., was surrendered to the owner in October and was afterwards operated on a development basis. The property is opened by a 2-compartment shaft 416 feet deep, a winze 285 feet deep, an inclined shaft 200 feet deep, and various laterals. Late in 1930 the owner did 125 feet of drifting in the mine and purchased a 50-ton flotation plant for treating silver-copper-lead ore.

Papago district.—The Shafer Mining & Milling Co. operated the Sunshine & Sunrise property and shipped one car of oxidized lead ore for smelting and nearly 380 tons of silver-lead concentrates. The company made no statement regarding development done in 1930 or the equipment of the milling plant.

Pima district (*Olive*, *San Xavier*, *Helmet Peak*, *Twin Buttes*).—Four lode mines in the Pima district produced 137 tons of ore yielding $294 in gold, 2,477 ounces of silver, 6,249 pounds of copper, and 39,506 pounds of lead, valued in all at $4,035, or $29.45 in metals a ton. The output in 1930 represented a marked decrease from that in 1929, when the metal output was valued at $72,227. The entire output in 1930 was lead ore, chiefly from the Esperanza group near Twin Buttes and from various prospects. The Venus group of the Buttes Copper Co., the chief producer in the district in 1929, was idle in 1930.

Silver Bell district.—Two lode mines and one old smelter dump in the Silver Bell district produced 3,241 tons of ore and clean-up material yielding $250 in gold, 484 ounces of silver, and 225,799 pounds of copper, valued in all at $29,790, or $9.19 in metals a ton. The metal output of the district in 1929 was valued at $431,487. The El Tiro property was operated during January by the American Smelting & Refining Co., which shipped more than 2,800 tons of copper ore to Hayden for smelting. In February, however, the option was relinquished, and the mine was returned to the owners. The Imperial mine, owned by the American Smelting & Refining Co., produced 308 tons of oxidized copper ore for smelting. The output from the El Tiro and Imperial properties in 1930 was only about one-tenth of that in 1929. The remainder of the district output consisted of several cars of clean-up material from the old smelter dump at Sasco. The Young America mine, owned by the Oxide Copper Co., formerly an important producer of copper, was not productive but was operated on a development basis by the American Smelting & Refining Co.; about 800 feet of drifting and extensive sampling were done in 1930.

PINAL COUNTY

In Pinal County 37 lode mines produced 2,608,643 tons of ore, a decrease of 1,284,485 tons from the output of 39 lode mines and 1 smelter dump in 1929. The gold decreased from $209,768 to $184,238, silver from 1,240,771 to 989,837 fine ounces, and copper from 105,817,156 to 68,761,598 pounds; the lead increased from 679,569 to 738,364 pounds. The total value of the metals decreased from $19,537,731 to $9,541,251, or more than 51 per cent, chiefly because of the decreased output of the Ray mines of the Nevada Consolidated Copper Co. and partly because of a slight decrease in output from the Magma mine at Superior. Nearly all (2,541,133 tons) of the ore was of concentrating grade and yielded 202,895 tons of concentrates, chiefly copper concentrates. First-class ore smelted amounted to 67,394 tons, and siliceous gold ore treated by amalgamation totaled 116 tons.

Banner district.—A small part of the Banner district extends from Gila County into Pinal County; no output was reported in 1930 from the part of the district in Pinal County.

Bunker Hill district (*Copper Creek*).—Four lode mines in the Bunker Hill district produced 492 tons of ore yielding $960 in gold, 13,073 ounces of silver, 44,779 pounds of copper, and 420,614 pounds of lead, valued in all at $32,845, or $66.76 in metals a ton. All the output was first-class smelting ore, and most of it was copper-lead ore from the Blue Bird group of the Fields Mining Corporation. The property, which is near Mammoth, is opened by a vertical shaft 557 feet deep and more than 3,900 feet of drifts. In 1930 the corporation did 197 feet of sinking, 1,069 feet of drifting, 143 feet of crosscutting, and 49 feet of work in the raises. Ore amounting to more than 400 tons was hauled to the railroad station at Winkelman and shipped to the lead smelter at Douglas. The Bunker Hill Arizona Mining Co. did chiefly development work in 1930 but shipped about 60 tons of material, most of which was sulphide copper-lead ore. The Copper Giant property, owned by the Calumet and Arizona Mining Co., was operated by lessees who shipped one car of oxidized copper ore. A small test lot of copper ore was also shipped from a prospect in the district.

Casa Grande district.—Three lode mines in the Casa Grande district produced 218 tons of ore yielding $308 in gold, 2,988 ounces of silver, and 1,071 pounds of copper, valued in all at $1,597, or $7.33 in metals a ton. The entire output in 1930 was first-class ore shipped to smelters; it represented a decrease from 2,709 tons of ore and old slag smelted in 1929. The Silver Reef mine near Casa Grande produced 195 tons of siliceous silver ore of smelting grade before the mine was closed early in January. A car of low-grade gold ore was shipped from the Goldback property 48 miles southwest of Casa Grande, and a test lot of gold ore was marketed from the Mammon property by lessees.

Goldfields district.—The Mammoth group of the Apache Trail Gold Mining Co. east of Mesa was not operated vigorously in 1930, but a little gold ore was treated in a 10-stamp amalgamation plant at the property by a leasing company—the Metallurgical Research & Mining Co. The resulting bullion was sold to the Denver Mint.

Hackberry district.—The output of the Hackberry district consisted of one car of siliceous gold ore containing silver and copper from the Venado mine 8 miles west of Winkelman and south of the Gila River.

Mineral Creek district (*Ray, Kelvin*).—Four lode mines in the Mineral Creek district produced 2,350,493 tons of ore yielding $12,822 in gold, 31,607 ounces of silver, 36,117,764 pounds of copper, and

287,327 pounds of lead, valued in all at $4,734,666, or $2.01 in metals a ton. The output consisted of 23,393 tons of first-class ore; 2,327,100 tons of mill ore, which were reduced to 113,921 tons of concentrates; and a little gold, silver, and copper from mine-water precipitates. In 1929 the output of the district was 3,610,423 tons of ore yielding gold, silver, copper, and lead valued at $11,732,376. In the last decade the output of the district has been chiefly from the Ray property, now owned by the Nevada Consolidated Copper Co. There was a decrease of nearly 36 per cent in the quantity of ore from the Ray mines milled at Hayden in 1930, a decrease of nearly 46 per cent in the output of copper, and a decrease in the output of both gold and silver. During 1930 the mine was worked 338 days; the 12,000-ton concentrator was operated 345 days at a greatly reduced rate. The property produced 2,349,974 tons of ore, of which 2,327,100 tons were treated at the Hayden mill and 22,874 tons, averaging 1.39 per cent copper, were shipped to the smelter at Hayden for converter lining. The mining cost, excluding depreciation and taxes but including all other overhead expenses, was 67.99 cents a ton, compared with 82.75 cents a ton in 1929. The milling cost was 38.16 cents a ton, compared with 39.45 cents a ton in 1929. The gross copper contained in the concentrates made at Hayden was 36,454,720 pounds, compared with 68,247,840 pounds in 1929; the first-class ore and the precipitates shipped to the smelter contained 692,253 pounds of copper. The net production for the year from all sources, after smelter losses were deducted, was estimated to be 36,107,056 pounds, compared with 66,259,703 pounds in 1929. The property ranked ninth as a producer of copper in Arizona in 1930 and was also a large producer of gold and silver. The mine is developed by vertical shafts and drifts; a total of 22,613 feet of work was done in 1930.

Mining and milling methods and costs at Ray and Hayden have been described in detail in reports [32] by the Bureau of Mines.. The mine and mill were also described in articles [33] published in February.

The Phelps Dodge Corporation leased the Ray Silver-Lead property and shipped nearly 500 tons of oxidized lead ore to Douglas. The option agreement with the owners of the property was terminated September 17. A small lot of oxidized copper ore was shipped from the Dunham property, under lease, and one car of lead ore was marketed from a prospect near Ray. Development was continued at the Copper State property where 600 feet of work have been done.

Mineral Hill district.—Three lode mines in the Mineral Hill district produced 137 tons of ore yielding $25 in gold, 152 ounces of silver, 29 pounds of copper, and 26,495 pounds of lead, valued in all at $1,412. At the property of the Jumbo Lead Mines (Inc.) near Florence a little lead ore was treated in a concentration plant equipped with a 20-ton Herman ball mill and Wilfley tables. One car of silver-lead concentrates was shipped to Douglas, but no development was done in the property in 1930. The remainder of the district output consisted of test lots of lead ore from prospects.

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[32] Thomas, R. W., Mining Practice at Ray Mines, Nevada Consolidated Copper Co., Ray, Ariz.: Inf. Circ. 6167, Bureau of Mines, 1929, 27 pp.

Garms, W. I., Concentrator Methods and Costs at the Hayden Plant of the Nevada Consolidated Copper Co., Ariz.: Inf. Circ. 6241, Bureau of Mines, 1930, 25 pp.

[33] Kumke, C. A., Recent Changes in Mining Methods at the Ray Mines of the Nevada Consolidated Copper Co.: Min. Cong. Jour., February, 1930, pp. 176–183.

Garms, W. I., Operations at the Hayden Concentrator: Min. Cong. Jour., February, 1930, pp. 186–192.

Old Hat district.—Six lode mines in the Old Hat district produced 415 tons of ore yielding $600 in gold, 1,304 ounces of silver, 52,980 pounds of copper, and 3,928 pounds of lead, valued in all at $8,186, or $19.73 in metals a ton. The output consisted of 411 tons of crude smelting ore and of test lots of ore, from prospects, treated by concentration and amalgamation. The Daily group near Oracle was worked for a short time and produced about seven cars of low-grade sulphide copper ore for smelting. The work, however, was unprofitable at the prevailing metal prices. The Winchester & Old Hat property at Oracle produced a small lot of oxidized lead ore which was shipped for smelting. The remainder of the output of the district consisted of copper ore and small lots of miscellaneous material from prospects.

Owl Head district.—Several cars of low-grade copper ore were marketed from mines in the Owl Head district in 1930, chiefly from the Last Chance No. 2 property which was under lease.

Pioneer district (*Superior*).—The Pioneer district extends into Gila County; all the district production in 1930, however, came from Pinal County where five lode mines produced 253,109 tons of ore yielding $165,764 in gold, 856,190 ounces of silver, and 32,384,741 pounds of copper, valued in all at $4,705,413, or $18.59 in metals a ton. The output consisted of 213,911 tons of ore of milling grade, which were reduced to 88,944 tons of concentrates, and 39,198 tons of first-class ore (chiefly copper ore). In 1929 the district produced 274,778 tons of ore yielding metals valued at $7,669,621. As in the past, the largest producer in the district was the Magma Copper Co., which operated its mine, mill, and smelter nearly 11 months. The quantity of ore produced at the Magma mine in 1930 decreased about 7 per cent from that in 1929; the output of copper decreased 17 per cent, gold about 10 per cent, and silver about 20 per cent. The mine ranked third as a producer of silver in Arizona in 1930, seventh as a producer of gold, and tenth as a producer of copper.

According to the annual printed report of the company the Magma mine produced a total of 251,872 tons of ore of all classes containing an average of 6.90 per cent copper and 3.31 ounces of silver and 0.033 ounce of gold to the ton. From above the 650-foot level lessees mined 226 tons of oxidized ore averaging 12.82 per cent copper and 12.38 ounces of silver and 0.081 ounce of gold to the ton. Most of the ore mined by the company was concentrated in the 600-ton combined gravity and flotation plant, which was worked 330 days. The mill ore averaged 6.46 per cent copper and the tailings 0.23 per cent, and extraction was 97.94 per cent of the copper. The concentrates, several thousand tons of first-class smelting ore, and 5,232 tons of custom concentrates and crude ore were treated in the company's 450-ton smelter at Superior, which was operated 319 days. The total net smelter production, after all losses including refining were deducted, was 31,884,271 pounds of copper, 937,383 ounces of silver, and 10,153.57 ounces of gold, of which 31,558,508 pounds of copper, 830,809 ounces of silver, and 8,518.50 ounces of gold were produced from smelting ore and concentrates from the Magma mine. The average net cost of producing copper, after the value of gold and silver was deducted, was 8.97 cents a pound, compared with 9.987 cents a pound in 1929. This cost does not include any allowance for depletion or Federal taxes but includes State and county taxes (about 0.97 cent a pound), depreciation, and all other fixed and general expenses. The average net selling price received for copper in excess of all commissions and delivery charges was 12.2377 cents a pound. In 1930 development consisted of 7,065 feet of drifting, 2,711 feet of raising, 4,433 feet of sinking, and 3,796 feet of crosscutting, a total of 18,005 feet for the year. The total to date is 177,960 feet.

Dividends paid to stockholders by the Magma Copper Co. from its organization to January 15, 1931, amounted to $9,969,139, of which four dividends totaling $1,734,659 were paid in 1930; a dividend of $306,116 was declared payable January 15, 1931. The dividend rate was decreased from $1.25 a share in April to $1 a share in July and again to 75 cents in October. Income from the sales of copper amounted to $4,510,043, and gold and silver sales amounted to $571,540; after various expenses were deducted the net gain for the year was $1,019,991, and the balance December 31, 1930, was $1,223,711.

The mining and milling methods and costs at the Magma mine were described in reports[34] published by the Bureau of Mines in 1929 and 1930.

The Reymert mine was operated by lessees, who shipped about 800 tons of siliceous silver ore to the smelter at Superior. No development was done at the property, except that necessary for mining from shallow workings along the outcrop. Several cars of low-grade oxidized copper ore were shipped from the Bomboy mine 6 miles west of Superior, and several cars of sulphide copper ore containing considerable silver were shipped from the Silver King property. The Crenshaw group near Watershead Peak produced three cars of sulphide copper ore containing about 4 per cent copper but practically no silver. The Belmont Copper Mining Co. operated the Belmont and Doggs properties near Superior until April 14 and did 4,066 feet of diamond drilling. The following paragraphs, regarding part of the property under lease, appeared in the company's annual report for 1930.

> In November, 1929, a lease for a period of six months was granted to Charles H. Smith of Superior on two of the company's claims, under the terms of which the company receives a percentage of the proceeds of any ore shipped. * * * The lessee with three miners repaired certain caved workings on the 140 level in the sedimentaries, which showed some copper carbonates. The presence of low-grade material encouraged the lessee to continue development, and a drift from a winze about 25 feet below the 140 level has exposed commercial ore for a distance of about 40 feet. In drifting east the ore has improved and now shows considerable copper sulphides and oxides in the form of solid chalcocite, cuprite, and malachite with good silver values for a width of between 4 and 5 feet. * * *

Price district.—A small lot of oxidized copper ore was shipped from the Sunset property one-half mile east of Price on the Southern Pacific Railroad.

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[34] Snow, F. W., Mining Methods and Costs at the Magma Mine, Superior, Ariz.: Inf. Circ. 6168, Bureau of Mines, 1929, 32 pp.
Rose, J. H., and McNabb, J. C., Milling Methods and Costs at the Concentrator of the Magma Copper Co., Superior, Ariz.: Inf. Circ. 6319, Bureau of Mines, 1930. 20 pp.

Red Hills district.—One lot of oxidized copper ore yielding metals valued at $530 was shipped to the smelter at Hayden from the Half Moon property 15 miles northeast of Florence.

Ripsey district.—The Florence Lead & Silver Mines (Inc.) operated its property near Ray the entire year and shipped more than 1,400 tons of siliceous silver ore to the smelter at Superior. The property is opened by 1,800 feet of drifts, raises, and stopes, but as a result of the serious drop in the price of silver operations ceased in May, 1931.

Sacaton Mountains (Blackwater) district.—Nearly 1,200 tons of oxidized copper ore were shipped from the Sacaton property 10 miles west of Florence. Early in 1931, however, the property was closed on account of market conditions.

Saddle Mountain district.—A small lot of gold ore from the Hoosier property was treated in an experimental amalgamation plant in July and August. The Adjust property of the Hope Metals Co., which is equipped with a 50-ton flotation plant, was idle in 1930. The property produced lead ore rich in silver in 1929.

Silver Bell district.—Nearly 600 tons of copper ore, containing considerable gold, were shipped from the Copper Blossom property from Munn on the Southern Pacific Railroad.

Summit district.—The Pinal Copper Co. operated the Fuhrmann property for three months under lease and shipped four cars of sulphide copper ore to the smelter at Superior. Later in the year negotiations were started with one of the larger copper companies of Arizona to prospect the property by diamond drilling. Several cars of copper ore containing considerable silver were shipped from the American property to various copper-smelting plants.

SANTA CRUZ COUNTY

Thirty-six lode mines in Santa Cruz County produced 29,862 tons of ore, 16,476 tons less than was reported from 38 lode mines and dumps in 1929. Ore of shipping grade amounted to 5,765 tons and yielded metals valued at $123,896. Ore to concentrating mills amounted to 24,097 tons; it was reduced to 1,829 tons of lead concentrates, 1,491 tons of zinc concentrates, 221 tons of copper concentrates, and 1 ton of gold concentrates yielding metals valued at $281,026. The total value of the metal output decreased $327,685, chiefly as a result of the closing of the Montana mill of the Eagle-Picher Lead Co., which suspended operations April 15.

Harshaw district.—Seven lode mines in the Harshaw district produced 2,390 tons of ore yielding $873 in gold, 82,616 ounces of silver, 27,208 pounds of copper, and 480,198 pounds of lead, valued in all at $60,227, or $25.20 in metals a ton. The output was all first-class ore of smelting grade, chiefly lead ore. The Trench Mining Co. operated the World's Fair mine the last five months of the year and shipped nearly 1,300 tons of sulphide lead ore containing considerable silver. The 60-ton flotation mill on the property was idle, and no development was done in 1930 in either the World's Fair mine or the Trench Josephine group. The Hardshell mine was operated by lessees, who shipped 768 tons of oxidized lead ore for smelting. The property is opened by a vertical shaft, an inclined shaft, and various drifts; the operators did 350 feet of drifting, sinking, and raising in

1930. Oxidized lead ore totaling more than 200 tons was shipped from the Flux property, which was operated by lessees who did 200 feet of underground development. The Black Eagle and El Ruido mines each produced one car of oxidized copper ore of smelting grade. A car of sulphide lead ore was shipped from the Mono group 7 miles southeast of Patagonia, and a sample lot of oxidized lead ore was shipped from the Curly Head prospect.

Nogales (*Gold Hill*) *district.*—The output of the Nogales district consisted of small test lots of first-class lead ore, copper ore, and siliceous gold and silver ore, chiefly from prospects on Gold Hill.

Oro Blanco district.—Except for one test lot of gold concentrates from ore mined at the Yellow Jacket prospect, the entire output of the Oro Blanco district was that of the Montana property of the Eagle-Picher Lead Co. at Ruby. For three years the Montana mine has been an important producer of lead and zinc; but the mill was closed April 15 due to market conditions, and the production in 1930 was therefore considerably less than that in 1929. The property is opened by a vertical shaft 715 feet deep and by various drifts and crosscuts. In 1930 the company did about 2,000 feet of development while the mine was operated on a 1-shift basis from April 15 to July 15, and from that time to the end of the year surface prospecting was done by diamond drilling. The Montana mine was by far the largest producer of silver, lead, and zinc in Santa Cruz County in 1930, in spite of the fact that the mill was closed early in the year. Lead concentrates and zinc concentrates, which were shipped to El Paso and Amarillo, Tex., contained considerable gold, silver, and copper in chalcopyrite and tetrahedrite as well as lead and zinc in galena and sphalerite. A report[35] covering the operations of the mill was published in 1931.

Pajarito district.—Small lots of lead ore were shipped from the Morning and other prospects near Nogales, and two small lots of lead concentrates were shipped from the Tin Can and Big Steve properties. The Tin Can property is opened by nearly 500 feet of underground work, and milling was done in a 20-ton dry concentration plant. Late in the year the mill was sold, as the recovery on the ore treated in 1930 was not satisfactory.

Palmetto district.—The output of the Palmetto district consisted of a small lot of oxidized lead ore from the Hassayampa group, one lot of copper precipitates from the Gray mine, and more than 200 tons of copper concentrates from the Three " R " property. The Three " R " flotation plant, which has a capacity of 140 tons a day, was operated for a short time, and about six cars of copper concentrates were shipped to Hayden for smelting. No statement was made by the Three " R " Mines (Inc.) regarding the development done in 1930.

Patagonia (*Washington*, *Duquesne*) *district.*—Seven lode mines in the Patagonia district produced 3,157 tons of ore yielding $991 in gold, 8,046 ounces of silver, 302,670 pounds of copper, 170,168 pounds of lead, and 130,806 pounds of zinc, valued in all at $58,223, or $18.44 in metals a ton. The entire output was first-class ore smelted, chiefly sulphide copper ore. The Santo Nino property was operated by the Southern Copper Mining Co. from January to June and by lessees the remainder of the year. The mine is opened by tunnels on four levels. The Southern Copper Mining Co. did 507 feet of drifting and raising in 1930; and the leasing company, the Santo Nino Mining Co., continued development from July to December and did 250 feet of lateral work. The mine produces ore containing molybdenite which is concentrated at Nogales and sulphide copper ore which is hauled to the railroad station at Zorilla, Sonora, Mexico. Lessees on the Duquesne property (including the Duquesne, Kansas, New York, and Texas claims) in Duquesne and Washington camps mined more than 400 tons of ore, the greater part of which was lead-zinc ore shipped to Coffeyville, Kans. Shipments of lead ore, oxidized copper ore, and copper-lead ore were also made from the district. The Gladstone-Proto property, 15 miles east of Nogales, was worked by lessees who shipped about 250 tons of sulphide copper ore to Hayden for smelting. The property is opened by a 500-foot tunnel, and the operators did about 100 feet of work in 1930. Other shipments consisted of 3 cars of sulphide lead ore from the Kansas & Belmont property, several cars of oxidized lead ore from the Pocahontas mine, 1 car of copper ore from the Buena Vista group, and 1 lot of lead ore from the Mowry mine.

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[35] Andrus, D. E., Milling Methods and Costs at the Montana Mine Concentrator of the Eagle-Picher Lead Co., Ruby, Ariz.: Inf. Circ. 6497, Bureau of Mines, 1931. 14 pp.

Tyndall district (*Alto*).—Eight lode mines in the Tyndall district produced 189 tons of first-class smelting ore yielding $152 in gold, 1,092 ounces of silver, 18,152 pounds of copper, and 18,032 pounds of lead, valued in all at $3,834, or $20.29 in metals a ton. The entire output of the district was made up of single shipments from various properties near Patagonia and Alto. A car of lead ore was shipped from the Wandering Jew property, sulphide copper ore from the Hilltop & Fox group, and similar material from the Frank Bailey and Connecticut properties. Small sample lots were shipped from the Bonanza, Alto, Salero, and Paloma claims. No development of importance was done at any of these properties, but drifting and tunnel work amounting to 600 feet were done at the Toluachi mine at Alto.

Wrightson district.—The Costello group, owned by the Gross Mining & Investment Co., was operated by lessees who shipped one car of sulphide lead ore to Douglas for smelting. The mine is opened by 3,000 feet of underground workings, chiefly in tunnels and drifts, and work totaling 450 feet was done in 1930. A test lot of copper ore was shipped from the Gringo prospect.

YAVAPAI COUNTY

In Yavapai County the production of each of the metals except lead and zinc showed a large decrease in quantity. Eighty-six mines were producing—five more than in 1929. The output of ore, old tailings, etc., decreased from 2,255,441 to 1,395,527 tons, gold from $1,693,404 to $1,214,133, silver from 2,810,859 to 1,930,906 fine ounces, and copper from 208,171,605 to 117,690,154 pounds; the output of lead increased from 153,613 to 236,620 pounds; the output of zinc was 9,930 pounds in 1930, and no zinc was marketed from mines in Yavapai County in 1929. The total value of the metals decreased from $39,839,473 to $17,269,559, or nearly 57 per cent.

Of the total (960,925 tons) first-class ore shipped to smelters 951,642 tons were sulphide copper ore; the total smelting ore yielded metals valued at $13,989,299, or an average of $14.56 to the ton. Concentrates amounting to 84,536 tons, derived from 422,415 tons of milling ore and from a little ore first treated by amalgamation, yielded metals valued at $3,183,007. Gold and silver bullion valued at $14,804 was recovered from 297 tons of ore treated by amalgamation and 10,000 tons of old tailings cyanided. Miscellaneous material, including old tailings smelted and smelter and mill clean-up material smelted, yielded gold, silver, and copper valued at $41,045. Copper recovered from precipitates was valued at $33,001. The placer output was $8,384 in gold and 49 ounces of silver, compared with $4,634 in gold and 31 ounces of silver in 1929.

Agua Fria district.—The Binghampton property, formerly a large producer of copper, was operated for a short time by lessees who shipped several cars of oxidized copper ore for smelting. A little development was done at the Barbara group of the Copper Mountain Apex Mines (Ltd.) and the Hatch-McGarvey property of the Verde Standard Copper Co.

Big Bug district.—Eight placers, 11 lode mines, and 2 dumps in the Big Bug district produced 3,983 tons of ore, old tailings, and smelter clean-up, $16,564 in gold, 38,773 ounces of silver, 355,160 pounds of copper, and 149,887 pounds of lead, valued in all at $85,157. The ore and miscellaneous material were valued at $20.57 in metals a ton. The output consisted of 2 tons of ore amalgamated, 564 tons of ore concentrated, 1,664 tons of crude smelting ore, 859 tons of old tailings smelted, and 894 tons of old smelter clean-up. The Blue Bell mine, formerly a large producer of copper ore, was operated until August by lessees who shipped more than 800 tons of oxidized copper ore to the smelting plant at Humboldt. This rebuilt smelter at Humboldt was operated by the Southwest Metals Co., under control of the Sheldon Mining Co., from February 4 until the latter part of May, after which nearly 900 tons of smelter clean-up material were shipped to copper smelters at Hayden and Clemenceau. Material containing gold, silver, and copper was shipped from the Henrietta tailings dump, and copper ore containing considerable gold was shipped from the Henrietta and Mountain Driver properties by lessees. The Arizona National property was operated for a short time by the Double O Metals Co., which shipped 3 cars of first-class lead ore and 4 cars of lead concentrates to El Paso, Tex., for smelting. No statement was made by the company regarding the activity of the mine or the development work done in 1930. The Hackberry (Boggs) group of the Phelps Dodge Corporation was worked in 1930 by lessees, who shipped about five cars of sulphide copper ore and two cars of siliceous gold ore for smelting. Lessees also operated the Gladstone-McCabe property near Humboldt and shipped two cars of siliceous ore containing chiefly gold. The Poland property at the head of Big Bug Creek 2 miles east of Walker was operated under lease and produced four cars of mixed ore, chiefly siliceous gold ore. Miscellaneous shipments came from the Lone Pine property which is developed by 2,700 feet of underground work, from the Lottie mine which produced one car of sulphide copper ore containing gold and silver, and from the Silverton group near Mayer which produced a little gold ore from the work of lessees. The placer output of the Big Bug district, valued at $3,242, was recovered from leasing properties on or near Big Bug Creek; it came chiefly from the Neptune, Uncle Dudley, and Windy groups near Mayer. Bench gravel was treated by sluicing at the Windy property 5 miles northwest of Mayer, and dry washing was used at various claims near Humboldt. Much of the material represents small purchases made by storekeepers at Prescott, Mayer, and Humboldt. The Yavapai Silver Co. did 400 feet of tunnel work at its Blue Rock property, and the Huron Copper Co. did some work in its vertical shaft.

Black Canyon district.—Six lode mines in the Black Canyon district produced 114 tons of ore yielding $1,383 in gold, 1,420 ounces of silver, 1,217 pounds of copper, and 5,485 pounds of lead, valued in all at $2,362, or $20.72 in metals a ton. The output consisted of 72 tons of smelting ore, 35 tons of concentrating ore, and 7 tons of ore treated by amalgamation. A car of siliceous gold ore from the Jacquelyn property was shipped to Hayden for smelting; a car of sulphide lead ore containing considerable gold and silver was shipped from the Turkey property near Cleator; and two test lots, one of silver ore and one of lead ore, from the Cutter group of the Silver Pheasant Mines (Inc.) were concentrated locally. About 100 feet of drifting were done at the Legal Tender group near Cordes, from which a test lot of oxidized copper ore was shipped for smelting. The remainder of the district output consisted of gold ore, chiefly from the Turkey Gobbler claims, treated by amalgamation. At the Thunderbolt property 200 feet of drifting were done on the 500-foot level; but no ore was treated or marketed during the year, and the mine was closed in September.

Black Hills district.—The output of the Black Hills district came from two lode mines and consisted of ore and old tailings yielding metals valued at $1,532. The Yaeger mine, which produced considerable ore in 1929, was operated only a short time by lessees who shipped a little sulphide copper ore and old tailings. A small lot of oxidized copper ore was shipped from the Jack Rabbit prospect.

Black Rock district.—Three lode mines in the Black Rock district produced 107 tons of ore yielding $666 in gold, 19 ounces of silver, and 4,809 pounds of copper, valued in all at $1,298, or $12.13 in metals a ton. Two cars of oxidized copper ore, containing considerable gold, from the Unida mine of the Golden State Trust & Mining Co., were shipped in the name of the Brayton Commercial Co. from Wickenburg, a station on the Atchison, Topeka & Santa Fe Railway. A little bullion was marketed from ore treated by amalgamation at the Amazon property of the Milevore Copper Co. (Ltd.), and a test lot of copper ore was shipped from the Roberts & Bouden claims near Constellation. The Copper Belt Smelter Co. (Inc.) operated the Texas & Wren group, owned by the Arizona Copper Belt Mining Co., and did 590 feet of development in 1930. The property is 12 miles northeast of Wickenburg and is opened by a vertical shaft and drifts, totaling nearly 1,600 feet of work.

Blue Tank district.—The mines in the Blue Tank district were virtually idle in 1930; the only output was a small sample of gold bullion produced from the Sahuaro property.

Cherry Creek district.—Three lode mines in the Cherry Creek district produced 201 tons of first-class smelting ore yielding $1,897 in gold, 74 ounces of silver, and 4,155 pounds of copper, valued in all at $2,465, or $12.26 in metals a ton. Most of the output was siliceous gold ore containing some copper from the Copper Bullion property 1 mile northwest of Cherry. One car of similar material from the Palmetto property was shipped to Hayden for smelting, and a car of gold ore was marketed by the Verde Annex Mines Co.

Copper Basin district.—Two cars of copper ore of smelting grade were shipped by the Logan Copper Co. from the Logan mine 3 miles east of Skull Valley. The Nine Strike Mining Co. was said to have done 250 feet of tunneling at the Tom Kimbrough mine; but no shipments were made, and work was suspended in March.

Copper Creek district.—Lessees shipped three cars of copper ore from two prospects 16 miles east of Cordes.

Deserted Hills district.—One car of siliceous gold ore was shipped from prospects in the Deserted Hills district. The shipping point is Divide, on the Atchison, Topeka & Santa Fe Railway north of the line between Yavapai and Maricopa Counties.

Eureka district.—Five lode mines in the Eureka district produced 20,731 tons of ore yielding $2,485 in gold, 1,175 ounces of silver, 246,021 pounds of copper, and 15,003 pounds of lead, valued in all at $35,670, or $1.72 in metals a ton. The output consisted of 20 tons of ore treated by amalgamation and concentration, 171 tons of crude smelting ore, and 20,540 tons of concentrating ore which was reduced to 489 tons of concentrates. Most of the ore was a milling product from the property of the Bagdad Copper Corporation 28 miles northwest of Hillside. The company is developing a low-grade copper deposit in monzonite, which is opened by a vertical shaft 370 feet deep and tunnels aggregating 7,000 feet. In 1930 the company did considerable underground development and 13,372 feet of diamond drilling from the surface and underground. The capacity of the mill was increased from 50 to 200 tons in 1930, and the plant was operated from April 15 to September 15. The output of the property consisted of one lot of first-class copper ore and nearly 500 tons of copper concentrates shipped to Magma and Hayden for smelting. The plant was closed September 15 on account of the marked decline in the price of copper and the expense of the long haul from the mine to Hillside. The deposit and the milling plant were described in an article[36] published in November. The Nieman & Crosby property was operated by lessees who shipped three cars of gold ore for smelting and treated a little gold ore by amalgamation and concentration. The Sultan property was operated by lessees who produced 34 tons of highly siliceous gold ore of smelting grade. Similar material was shipped from the Mammoth group 8 miles north of Hillside, and development for the year consisted of 260 feet of sinking and 200 feet of work in drifting and crosscutting. Lessees shipped one car of oxidized lead ore from the Last Chance property near Boulder Creek.

Hassayampa district.—Three placers and 12 lode mines in the Hassayampa district produced 1,722 tons of ore, $25,042 in gold,

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[36] Young, G. J., Another Porphyry Copper in the Making: Eng. and Min. Jour., vol. 130, Nov. 24, 1930, p. 522.

11,993 ounces of silver, 40,474 pounds of copper, 21,835 pounds of lead, and 9,930 pounds of zinc, valued in all at $36,489. The ore was valued at $20.73 in metals a ton. The placer output consisted of $622 in gold and 5 ounces of silver. The lode mines produced 226 tons of ore treated by amalgamation, 1,141 tons directly smelted, and 355 tons of concentrating ore. More than 800 tons of gold ore containing considerable silver and copper were shipped from the Ore Flame property (Sterling group) by lessees; 200 feet of development were done at the property, and it was sold later in 1930 to the Ore Flame Mining Co. The Midnight Test property, an old producer near Prescott, was under option and lease during part of 1930 to the National Exploration Co.; one car of rich gold ore and two cars of concentrates containing considerable gold were shipped for smelting. The Davis-Dunkirk Mines (Inc.) operated its property near Prescott for a short time and disposed of one car of crude copper ore and one car of copper concentrates, both containing gold and silver. Several cars of sulphide copper ore of smelting grade were shipped from the Senator group, which was operated by lessees. The Monte Cristo property near Groom Creek was operated by a lessee who treated 100 tons of gold ore in a 5-ton amalgamation plant; about 150 feet of tunnel work were done in 1930, and bullion was sold to the San Francisco Mint. Small lots of bullion from the Empire property, Harrison mine, and prospects near Venezia were also marketed in California. One car of copper ore of smelting grade was shipped from the Lucky Strike group of the Arizona-Oregon Development Co., one car of copper-lead ore was marketed from the Josephine group of the Chase Mines (Inc.), and a small lot of copper precipitates was shipped from the Snoozer group owned by the Phelps Dodge Corporation. The Crook, Westerner, and Starlight groups near Venezia were operated a short time by the Westerner Gold-Lead Mines Co.; about 100 tons of gold ore were treated by amalgamation, and one car of lead-zinc ore was shipped to a custom mill in Utah as a test. The Storm Cloud property, the chief producer in the district in 1929, was idle in 1930. The placer output of the district consisted of small lots of dust or bullion from Hassayampa and Groom Creeks, sold to storekeepers at Prescott.

Humbug district.—The Lapan group near Hot Springs produced one car of oxidized lead ore which was shipped to Douglas, Ariz.

Martinez district.—The entire output of the Martinez district was gold and silver bullion resulting from cyanidation operations at the tailings dump of the old Congress mine. About 10,000 tons of the material was treated in 1930 by the Southwest Metal Extraction Corporation in a 400-ton mill. No work was done in the Congress mine; the mill was closed in August to permit remodeling of the plant and increase of its capacity.

Peck district.—The De Soto mine was operated from January to August by lessees who shipped more than 6,000 tons of oxidized copper ore containing gold and silver. However, no development was done in the property except the work necessary in taking out the ore. The output was less than half that in 1929.

Silver Mountain district.—A test lot of gold ore from the Gold Coin property was treated by amalgamation in an arrastre.

Squaw Peak district.—No ore was produced from the Squaw Peak district in 1930, but the Squaw Peak Copper Mining Co. did about 900 feet of tunnel work at the L. M. Olden group. The tunnel is now 1,190 feet long, and it is estimated that the company has 500 or 600 feet more work before a connection is made with the proved ore.

Thumb Butte district.—The only output in the Thumb Butte district was one lot of oxidized copper ore shipped from the Willow Creek prospect to the smelter at Hayden.

Tip Top district.—No output was reported from mines in the Tip Top district in 1930, but a small lot of slag containing gold was cleaned up from one of the old mill sites.

Turkey Creek district.—The output of the Turkey Creek district consisted of 7 tons of oxidized copper ore, containing considerable silver, from the Goodwin group near Bolado and a small lot of placer bullion. The ore yielded metals valued at $556, and the placer output was valued at $93.

Verde district (*Jerome*).—There was such a decided decrease in the output of the Verde district and in metal prices in 1930 that the value of the district output decreased nearly 57 per cent from that in 1929, when the region ranked first among the districts of Arizona in value of output. In 1930 the Verde district ranked third in value of output after the Globe district and the Warren (Bisbee) district. The exact output of the Verde district is not given in this report, as the United Verde Copper Co., the largest operator, publishes no annual report and objects to having its production made public. In general, however, the output consisted of copper ore of smelting grade from the United Verde and United Verde Extension mines; copper ore of concentrating grade from the United Verde, United Verde Extension, and Verde Central mines; and small lots of copper ore and precipitates from the Copper Chief mine and various prospects. Most of the district output of first-class ore and concentrates was reduced to blister copper at the copper smelters at Clarkdale and Clemenceau. More than 60 per cent of the copper output of the district was from the United Verde mine.

In recent years the United Verde mine has ranked first in Arizona in production of gold, silver, and copper. In 1930 it retained first place in production of gold and silver but dropped to second place in copper. The company mine at Jerome and smelter at Clarkdale were operated continuously in 1930, but the mill was active only six months. Seventy-three per cent of the total ore produced from the mine during the year was of smelting grade and was shipped direct to the smelter at Clarkdale. The 5,000-ton smelter is equipped with both blast furnaces and reverberatories, as well as the usual roasters and converters; but in 1930 reverberatories were used to the exclusion of the blast furnaces, which were so efficient in the past, especially on first-class pyritic ore. The capacity of the flotation mill at Clarkdale was increased from 1,200 to 1,600 tons a day. It was closed in July, however, after which the smelter was operated entirely on first-class ore. Although most of the mine output came from underground operations in 1930 a large quantity of ore was mined on three levels in the open pit at the site of the old smelter and dropped down to a haulage level below. The underground portion of the mine is opened by lower adit tunnels and two shafts to the 3,150-foot level. During 1930 the company did 16,917 feet of development in various workings and operated the mine and open pit the entire year. In January production from the property was materially curtailed; and work was started on the new shaft to replace the No. 5 and No. 6 shafts, which will eventually reach a depth of 5,000 feet. A comprehensive review [37] of every phase of the United Verde enterprise, including details on history, mining, milling, smelting, and research, was published in April. Under the section dealing with milling the ore treated by flotation and the results obtained are given for 1928 and 1929. In 1929 the mill treated 472,641 tons of ore averaging 3.39 per cent copper, 0.706 ounce of silver, and 0.011 ounce of gold. The ratio of concentration was 5.11 to 1; and the plant made 92,459 tons of concentrates containing 16.03 per cent copper, 2.672 ounces of silver, and 0.0315 ounce of gold. The recovery to the ton of concentrates was 92.49 per cent of the copper in the feed, 71.38 per cent of the silver, and 57.85 per cent of the gold. Pyrite constitutes more than 20 per cent of the mill ore, and more than 69 per cent of it is rejected in milling. The review also gives details on the smelting practice at Clarkdale and compares the work of the blast furnaces and reverberatories. The mineralogy of the deposit and the work of the research department have especial interest as the ore contains zinc as well as copper, and as it was reported in the press that the construction of a 500-ton unit for the mill had been started in 1930 to make tests on saving copper and zinc concentrates. Besides the articles cited three detailed reports,[38] describing mining and milling practices, were published by the Bureau of Mines during 1930 and 1931.

Most of the ore from the United Verde Extension mine was treated in the company copper smelting plant at Clemenceau, but more than 17,000 tons of highly siliceous copper ore were shipped to Hayden and Humboldt for use as converter lining. The mine and 800-ton smelter were operated continuously; and the property ranked fifth in production of silver in Arizona in 1930, sixth in gold, and seventh in copper. According to the company's annual report the smelter at Clemenceau treated 251,849 tons of company ore averaging 7.40 per cent copper and 0.039 ounce of gold and 1.34 ounces of silver to the ton. In addition to the ore smelted the company treated 33,479 tons of ore in the new flotation plant, and the resulting concentrates were smelted with the crude ore. The yield from crude ore and concentrates was 38,883,409 pounds of copper. The siliceous copper ore shipped for smelting yielded 1,934,405 pounds of copper, as well as gold and silver. Custom ore and concentrates purchased and treated at the smelter (13,243 tons) yielded 4,749,414 pounds of copper, besides gold and silver. The custom material was chiefly copper concentrates from the Verde Central mill. The cost of producing 1 pound of copper from the United Verde Extension mine was as follows: Mining, 2.84 cents; concentrating and smelting, 2.32 cents; freight on ore, 0.08 cent; freight on bullion, refining, and selling, 1.79 cents; and other expenses, including custom ore, 1.46 cents; total, 8.49 cents. This cost does not include depreciation, depletion, or taxes. Gross revenue from the sale of bullion (including that from custom material) and ore amounted to $5,536,974, which, when added to other revenue ($305,026), amounted to $5,842,000. Deductions of charges for mine and smelter operations, ores and concentrates purchased, freight, refining, selling, and other expenses including taxes amounted to $4,486,145. Earnings from operations were $1,355,855, and after $2,869,716 was deducted for depletion and depreciation a net loss of $1,513,861 remained. Dividends paid to stockholders in 1930 amounted to $3 a share, or $3,150,000 in all, making a total dividend disbursement of $37.85 a share, or $39,742,500, paid since the organization of the company in 1916. At the smelter reverberatory furnace No. 1 was operated 298 days; No. 2, 345 days; and the blast furnace, 24 days. For the first time in the history of the company part of the ore from the mine was milled. Construction of the new mill was started in May, and the plant had its initial run early in August. The company operated the new 200-ton flotation plant for five months and treated 33,479 tons of copper ore containing 4.21 per cent copper and 0.93 ounce of silver and 0.043 ounce of gold to the ton. An article[39] describing the new concentrator appeared in October. The mine is opened by a vertical shaft 1,900 feet deep and by 197,525 feet of various drifts, raises, and tunnels. In 1930 the company did 13,135 feet of development, consisting of 10,846 feet in drifts and 2,289 feet in raises. The greater part of this work was done on the 950, 1,100, 1,200, and 1,300 levels; virtually no work was done on the 1,900 (lowest) level. A report[40] describing operations at the mine was published early in 1930. The company report continues:

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[37] Mining Congress Journal, The United Verde Copper Co.: April, 1930, p. 300.

[38] Alenius, E. M. J., Methods and Costs of Stripping and Mining at the United Verde Open-Pit Mine, Jerome, Ariz.: Inf. Circ. 6248, Bureau of Mines, 1930, 34 pp.

Kuzell, C. R., and Barker, L. M., Milling Methods and Costs at the Concentrator of the United Verde Copper Co., Clarkdale, Ariz.: Inf. Circ. 6343, Bureau of Mines, 1930, 28 pp.

Quayle, T. W., Mining Methods and Practices at the United Verde Copper Mine, Jerome, Ariz.: Inf. Circ. 6440, Bureau of Mines, 1931, 31 pp.

> Due to the development of additional ore northward and upward above the 1,207 country there is estimated to be nearly the same tonnage of ore in sight as a year ago, but average grade is somewhat lower.
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> We have measured ore amounting to about 600,000 tons of an average grade of approximately 7 per cent copper.
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> An option on a majority of the stock of the Old Vulture Gold mine in Maricopa County, Ariz., extending until 1932, has been secured, and a shaft is being sunk; and at a depth of about 450 feet it is expected that quartz will be encountered.

The Verde Central Mines (Inc.) treated in its flotation mill 92,876 tons of ore averaging 2.477 per cent copper from the Verde Central mine and shipped 10,721 tons of concentrates containing 19.96 per cent copper. Operations, however, at both the mine and the 400-ton flotation mill were suspended October 31, and it was planned early in 1931 to dispose of all property. The concentrates were smelted at the United Verde Extension smelter at Clemenceau, and the Verde Central Mines (Inc.) reported that the concentrates shipped in 1930 contained 4,279,846 pounds of copper and 20,084 ounces of silver. The mine is opened by a vertical shaft 1,930 feet deep; 1,367 feet of development was done in 1930. The mill, which had its initial run in January, 1929, began operations with a capacity of 300 tons a day.

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[39] Huttl, J. B., United Verde Extension's New Concentrator at Clemenceau: Eng. and Min. Jour., vol. 130, October, 1930, p. 317.

[40] D'Arcy, R. L., Mining Practice and Methods at the United Verde Extension Mining Co., Jerome, Ariz.: Inf. Circ. 6250, Bureau of Mines, 1930, 11 pp.

In June, 1929, a Symons cone crusher was added to the equipment, and the capacity was raised to 400 tons a day. The Verde Central mill was fully described in a circular [41] issued in September, 1931, which gives the history of the plant, the flow sheet, the results of the treatment by flotation, and the costs during June and July, 1930. Details of operations at the Verde Central property were formerly included in the annual reports of the Calumet and Arizona Mining Co., but the property was not mentioned in the report for 1930. Mining operations at the property were described in a circular [42] issued in 1931.

Walker (Lynx Creek) district.—Three placers and two lode mines in the Walker district produced 23,619 tons of ore, $20,508 in gold, 78,476 ounces of silver, 908,377 pounds of copper, and 36,693 pounds of lead, valued in all at $170,645. The ore averaged $7.12 in metals a ton. Nearly all (23,470 tons) of the ore was of concentrating grade and was reduced to 6,047 tons of concentrates; the remainder consisted of 145 tons of crude smelting ore and 4 tons of ore treated by amalgamation. The placer output was valued at $2,378 and contained 114.79 ounces of gold and 14 ounces of silver. Except for one small lot of gold ore from the Pine Mountain prospect, treated by amalgamation, the entire output from lode mines in the Walker district came from the Eureka, Fortune, and Sheldon claims of the Sheldon Mining Co. Both the Sheldon mine and 200-ton milling plant 2½ miles southwest of Poland were operated until September 18. The output of the mine was chiefly ore of milling grade, although several cars of copper ore of smelting grade were marketed. Shipments consisted chiefly of copper concentrates containing gold and silver, which were sent to Humboldt and Clemenceau for smelting. The Sheldon property is opened by an inclined shaft 1,250 feet deep, and in 1930 the company did 625 feet of work in drifts and raises. Part of the placer output of the district consisted of small lots of gold purchased by storekeepers at Prescott, but most of it was shipped from the Myrtle and Jumble claims worked by the Arizona Dredging & Power Co. The property is 12 miles northeast of Prescott on Lynx Creek, and the company treated 12,000 yards of gravel in a small washing plant to test the ground for dredging.

Walnut Grove district (Wagoner).—The output of the Walnut Grove district consisted of small lots of placer bullion valued at $212 from prospects near Kirkland. The Hassayampa Gold Mining Co. reported doing 270 feet of development in its lode property in 1930, chiefly in a crosscut.

Weaver district.—Four placers and three lode mines in the Weaver district produced 192 tons of ore, $3,188 in gold, 105 ounces of silver, and 5,300 pounds of copper, valued in all at $4,218. The placer output was valued at $1,854 and came from the Rich Hill property and various claims near Octave. Two cars of gold ore of smelting grade were shipped from the Dora (Koerber) mine 1 mile east of Octave, one car of oxidized copper ore containing considerable gold was shipped from the Lucky Three claim 8½ miles southwest of Kirkland, and one lot of similar material was shipped from the Black Warrior mine. The St. Elmo Mines (Inc.) did 334 feet of development in its property near Congress Junction, and the Emerson Mining Co. continued to develop the Bee Hive and Bishop groups 12 miles east of Congress Junction. The Arizona-Eastern Gold Mines Co., the largest producer in the district in 1929, was idle in 1930.

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[41] Dickson, R. H., and Smith, E. M., Milling Methods and Costs at the Verde Central Concentrator, Jerome, Ariz.: Inf. Circ. 6489, Bureau of Mines, 1931, 12 pp.

[42] Dickson, R. H., Mining Methods and Costs of Mining Copper Ore at the Verde Central Mines (Inc.), Jerome, Ariz.: Inf. Circ. 6464, Bureau of Mines, 1931, 13 pp.

White Picacho district.—No output was reported from the White Picacho district north of Wickenburg. About 600 feet of drifting, however, were done at the Great Southern property which is opened by nearly 1,700 feet of work.

YUMA COUNTY

The total value of the production of gold, silver, copper, and lead in Yuma County was $138,438 in 1930, compared with $116,357 in 1929. The output of gold and silver decreased, but the output of copper and lead increased. Twenty-three lode mines produced 16,633 tons of ore and old tailings. The placer output was $2.285 in gold and 17 ounces of silver. Gold and silver bullion valued at $936 was recovered from 153 tons of ore and old tailings treated in amalgamation plants. The chief producers in the county were the Lion Hill mine in the Cienega district, a producer of gold ore; the Clara-Swansea mine in the Planet district, a producer of copper ore; and the New Deal mine in the Castle Dome district, a producer of lead ore.

Castle Dome district.—Five lode mines in the Castle Dome district produced 164 tons of ore yielding $75 in gold, 1,263 ounces of silver, 384 pounds of copper, and 73,198 pounds of lead, valued in all at $4,271, or $26.04 in metals a ton. The district metal output in 1929 was valued at $3,305. The output in 1930 consisted of 32 tons of first-class smelting ore and of 132 tons of milling ore which was reduced to 44 tons of concentrates. Most of the output came from the New Deal (De Luce) group and was chiefly lead ore of milling grade, with one lot of first-class material. Small lots of lead ore were also shipped from the Silver Dollar property and the Mable group, and one sample lot of copper ore was marketed from the Copper Glance property.

Cienega district.—Four lode mines in the Cienega district produced 324 tons of ore and old tailings yielding $8,406 in gold, 53 ounces of silver, and 30,294 pounds of copper, valued in all at $12,364, or $38.16 in metals a ton. The output consisted of 150 tons of old tailings and 174 tons of first-class smelting ore. The largest producer in the district was the Lion Hill Gold Mining Co., which operated the Lion Hill and Glory groups and shipped gold bullion from the treatment of old tailings and several cars of rich gold ore. The mine was operated continuously in 1930, and approximately 700 feet of development were done. Early in November a 25-ton rod mill and amalgamation plates were installed, and the plant was operated on old tailings the remainder of the year. Two cars of oxidized copper ore containing considerable gold were shipped from the Johnson & Bunch claims where 140 feet of development were done in 1930. Similar material was shipped from the Black Hills property and from a prospect near Parker.

Ellsworth district.—Seven lode mines in the Ellsworth district produced 164 tons of ore yielding $2,991 in gold, 136 ounces of silver, 7,282 pounds of copper, and 5,119 pounds of lead, valued in all at

$1,246, or $25.89 in metals a ton. The output consisted of 151 tons of first-class smelting ore, 10 tons of ore concentrated, and 3 tons of ore treated by amalgamation. One car of rich gold ore and one car of lead ore containing considerable gold were shipped from the Bonanza & Golden Eagle property by way of Salome on the Santa Fe, Prescott & Phoenix Railway. Lessees shipped two cars of oxidized copper ore from the Critic mine near Wenden, and one car of rich gold ore was shipped from the Gold Leaf property. A small lot of gold ore was also shipped from the Edna May property, and samples of copper ore were shipped from the Noralie and W. J. B. claims. The Britannia Gold Mines (Inc.), which leased the Minnezona & Black Cat group in 1930, produced a little gold bullion and a small lot of lead concentrates containing gold and silver. The Harqua Hala Extension Mining Co. near Salome did 600 feet of work in drifts and raises; development was also done at the Arizona Big Indian property.

Kofa district.—The Sheep Tanks (Resolution) property, a producer of more than 800 tons of rich gold ore in 1929, was idle in 1930.

Laguna district.—Three placers in the Laguna district produced small lots of bullion, valued in all at $839.

Planet district.—The Clara-Swansea property was operated until July 21 by the American Smelting & Refining Co. The mine is opened by a shaft 400 feet deep and 3,475 feet of drifts; in 1930 the company did 253 feet of raising, 350 feet of crosscutting, and 475 feet of drifting. A new 250-ton flotation plant was completed early in the year and operated from May 1 to July 21, after which it was closed because of the decided decrease in the price of copper. Some first-class smelting ore and more than 1,500 tons of copper concentrates were shipped to Hayden for smelting.

Plomosa district.—Three placers and four lode mines in the Plomosa district produced 308 tons of ore, $1,599 in gold, 1,654 ounces of silver, and 28,193 pounds of copper, valued in all at $5,901. The ore averaged $14.44 in metals a ton. Placer bullion yielding $1,449 in gold and 10 ounces of silver was recovered by dry washing near Quartzsite. Most of the ore output consisted of oxidized copper ore shipped from the Newmont property 14 miles east of Quartzsite by the Apache Metals (Inc.). The company shipped 252 tons of ore averaging 5.26 per cent copper and did 700 feet of development in drifts and winzes in 1930; however, in June work was discontinued on account of the low price of silver and copper. One car of oxidized copper ore was shipped from the Excelsior property where considerable work was done in opencuts. The remainder of the district output consisted of one lot of copper ore from the Roy T. Bowyer property and sample lots from prospects near Quartzsite. Considerable work in retimbering part of the shaft and crosscut at the Copper Chief property near Quartzsite was done by the Copper Chief Mines Co.

Santa Maria district.—One car of sulphide lead ore was shipped from the East Side property near Bouse by lessees, and one small lot of oxidized material was shipped from a prospect also near Bouse.